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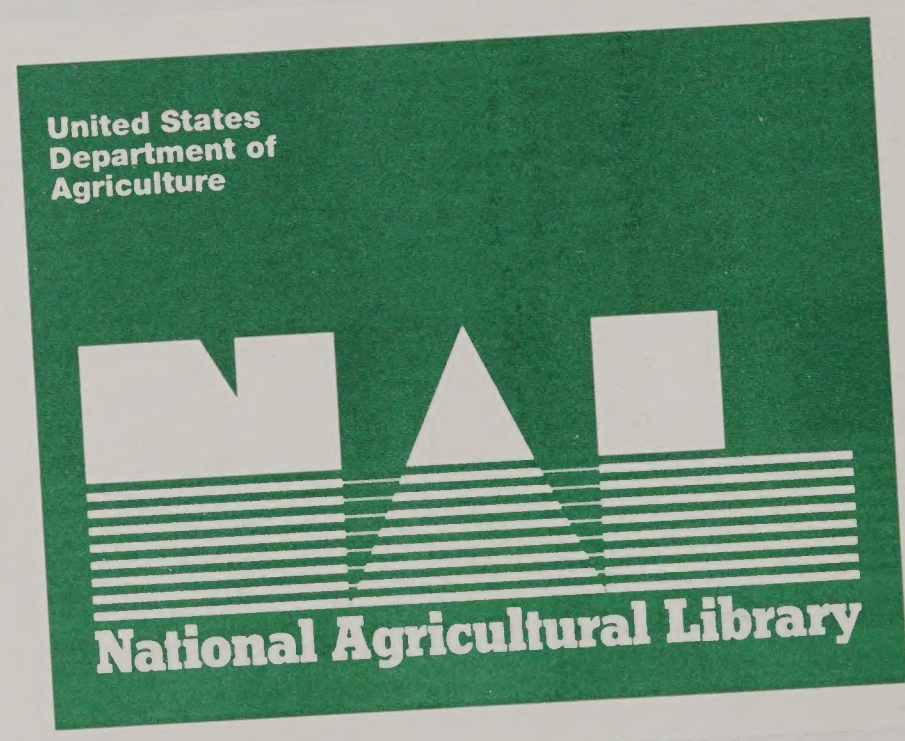
Using the Linker

Output, Input, and Operation

Ralph Seeley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Abstract

The linker is a set of computer procedures that combines agricultural economic country models into a world system that can be used for scenario analyses. The models generally have exogenous macroeconomic and resource blocks but have endogenous prices, quantities, and policy behavior for grains, oilseeds and products, and animal products. Most of the models are spreadsheet-based, with the exception of the U.S. and rest-of-world models, which are based in the Fortran programming language. The linker combines the models even though they reside in disparate software packages, appropriate to the needs of the respective analysts. Software has been selected or internally developed with the goal of facilitating input of expertise from country/regional, commodity, and other analysts.

The combined country models and the linker are referred to as the Country Linked System (CLS). The CLS is being used to perform middle-run scenario analysis in the Market and Trade Economics Division. The linker is not the best answer to combining the models, because it is large and slow. Instead, the linker is a functioning platform on which to work out input needs, efficient processes, and desired output. We can evaluate other modeling and solution software packages on their ability to meet or exceed the capabilities of the CLS. In the meantime, the CLS makes possible a number of scenario analysis projects.

This report describes how to locate and interpret the output, how to set up the linker's control files, and how to run the linker and deal with typical problems.

Limitations

Projection files on the LAN "BASELINE" (H:) drive generally will be preliminary. Results may need clearance before being quoted outside the U.S. Department of Agriculture (USDA). Raw model results probably do not represent USDA positions. The USDA cannot publicly project cotton prices. The linker is a work in progress; see the electronic version of this report for the latest revisions. The country/regional models also are works in progress; analysts may be working on models even as a run is in progress. There are a few instances of problems such as negative trade numbers or supply not quite equal to demand, and so forth, in some countries and commodities. While modelers can take a few such problems in stride, non-modelers may not. Your constructive comments would be helpful.

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Washington DC 20036-5831

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Contents

Acknowledgments

Many people have contributed directly or indirectly to the CLS over the years, so it is unlikely that the lists below are complete (also see U.S. Dept. Agr., 1997; U.S. Dept. Agr., 1996; and Seeley, 1994). No attempt is made to estimate how much time each individual contributed. Only contributors from the Economic Research Service and the World Agricultural Outlook Board are listed here.

John Dunmore and Mike Price originally requested development of the linker. People who provided management services during development of the linker include Harry Baumes, John Dunmore, Rip Landes, Mike Price, Robert Reinsel, Mathew Shane, Fred Surls, Ronald Trostle, and Paul Westcott. People who provided useful advice during construction of the linker include Darina Batkova, John Dyck, Gene Hasha, Kim Hjort, Bill Kost, Rip Landes, Myles Mielke, Mike Price, Robert Reinsel, Mathew Shane, Paul Westcott, Carolyn Whitton, and many others.

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Some terminology is taken from the IIASA world agriculture model (Fischer and Frohberg, 1982).

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Using the Linker: Output, Input, and Operation

Ralph Seeley*

Introduction

The linker is a computerized procedure for making a price-endogenous modeling system from individual country models created in the Economic Research Service (ERS). The main components are foreign country models built by country analysts, and the Fapsim model of the United States. The linker allows individual models to be run together for scenario analysis, giving endogenous equilibrium prices and quantities. The combined models and linker are referred to as the Country Linked System or CLS.

The spreadsheet-based foreign country models generally respond to world prices, and have standardized commodity definitions and units for the quantities to be linked. A few other characteristics of these spreadsheet models are specified to enable linking. The Fapsim model of the United States is a large-scale econometric model with commodity-specific policy details. All of these models produce results for each of several projections years. All of these models project total imports and exports by each country, as opposed to origin-destination trade.

This report covers the linked system output first, because that is of interest to the largest number of users. This writeup next explains the linker's control files, covering both the relational database format of the control files, and the variables. Finally, the discussion goes over the operation of the linker, including typical problems and their solutions. The last material probably will be of most interest to the person who wishes to run the linker. The electronic version of this report, LINKSYS.WPD, contains internal hypertext links and is maintained on the LAN H: drive, which is discussed below.

Project and Scenario Output on the LAN

CLS information currently is stored on the LAN in the BASELINE directory, which for most users is accessed automatically as the H: drive. If you don't have access to the H: drive, go to DOS while connected to the LAN and enter **NET USE H: BASELINE** or
NET USE H: \\D05SV10\BASELINE or contact the Information Services Division (ISD) Help Desk. The material on the H: drive is intended to assist MTED analysts; feel free to explore. Output is generated in various formats to meet the needs of different analysts and different projects.

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*Ralph Seeley is an agricultural economist with the Market and Trade Economics Division, Economic Research Service, U.S. Department of Agriculture.

Scenario Analyses Done with the Full CLS

Southeast Asia crisis, shocks to income and exchange rates; for Glauber, Collins, and Glickman.

Baseline projections, including Asia crisis, Conservation Reserve Program (CRP), General Agreement on Tariffs and Trade (GATT), and Acreage Reduction Program (ARP) scenarios; for the World Agricultural Outlook Board (WAOB), the Foreign Agriculture Service (FAS), and other agencies.

- 1994/**95**
- 1995/**96** including publication of international projections
- 1996/**97** including publication of international projections
- 1997/**98**

European Union enlargement: accession of Czech Republic, Hungary, Poland, and Slovakia; for Leetmaa and Jones.

Baseline-related projections for Asia and historical pattern yield shocks; for Landes and the Food and Agriculture Organization of the United Nations (FAO): Food security in Asia.

Effects of Taiwanese pork industry foot-and-mouth disease; for Dunmore and Collins.

China scenarios; for Colby, Crook, Hjort, and MEDEA project.

- Ozone limits yields
- Full trade liberalization
- Water shortage reduces yields
- Faster decline in arable land
- Income growth moderation

Multi-country, multi-commodity yield reduction shocks to simulate a high-food-price scenario alternative to the baseline projections for long-term food aid needs and availabilities; jointly requested by the State Department, the U.S. Agency for International Development (USAID), FAS, and the Central Intelligence Agency (CIA).

Russian income growth scenarios; for Sedik and Liefert.

Analysis of export program impacts; for FAS and Trade Programs Coordinating Committee (TPCC), under the Office of Management and Budget (OMB).

- Export Enhancement Program (EEP)
- GSM credit guarantees
- PL-480
- Section 416

Canadian Western Grain Trade subsidy reductions; for Stout, Hasha, and others.

GATT income, tariff, etc. changes; for Hasha, Herlihy, and others.

Slower income growth in developing countries; for Landes.

Western Hemisphere trade integration with bilateral tariff reductions; for the International Agricultural Trade Research Consortium (IATRC).

Comparing Results

The country and commodity tables may include various presentations of scenario and base results, as listed below:

Type of table	Four-char. code	Two-char. code	Equation
Base or reference run	BASE	BA	$Base_t$
Scenario run	SCEN	SC	$Scenario_t$
Differences	S-B	DF	$Scenario_t - Base_t$
Percent differences	%S-B	PC	$(Scenario_t / Base_t - 1) * 100$
Base annual growth rates	Gr.B	GB	$(Base_t / Base_{t-1} - 1) * 100$
Scenario annual growth rates	Gr.S	GS	$(Scenario_t / Scenario_{t-1} - 1) * 100$
Base annual changes	Ch.B	CB	$Base_t - Base_{t-1}$
Scenario annual changes	Ch.S	CS	$Scenario_t - Scenario_{t-1}$

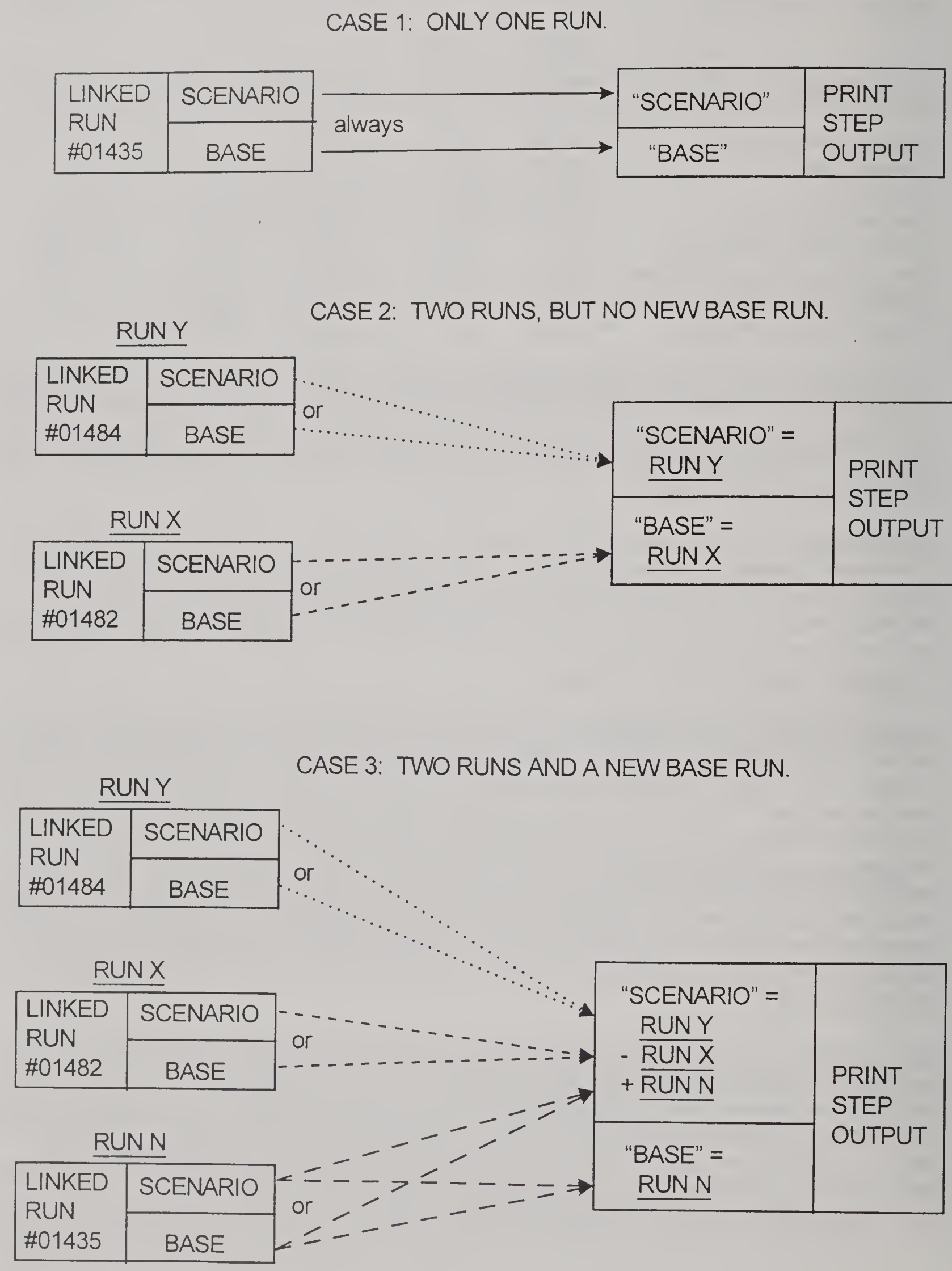
Only One Run. The preceding table concerns the *output* "scenario" and "base." Descriptions of output that use the words *scenario* or *base* without any qualifiers, refer to the output "scenario" and "base." No further distinctions are needed where just one run is being examined; the run scenario is always used as the output "scenario," and the run base is always used as the output "base." See Figure 1, Case 1.

Two Different Runs. The linker's output step can compare the results from two different runs. The output "scenario" is drawn from run Y, while the output "base" is drawn from run X. The original scenario or base portion of run Y may be selected as the output "scenario," and the original scenario or base portion of run X may be used as the output "base." The usual practice is to select the scenario part of run Y as the output "scenario," and the scenario part of run X as the output "base." See Figure 1, Case 2.

Applying Differences to a New Base. Occasionally it becomes important to apply the differences between run Y and run X, to a new *output* "base" drawn from run N. Then, the output "scenario" = run Y - run X + run N, while the output "base" is taken from run N. The run N scenario or base may be selected. This output variation also re-adjusts for any year offset that might have been introduced between the U.S. and foreign models because the foreign models did not become endogenous at an early enough year for the scenario in question. However, the output step cannot correct for year-offset issues that key on absolute levels of policy thresholds, such as the wheat price at which the European Union can export without subsidy. It is preferable to use the same versions of the country models so the calculations don't work with data from one model, but zeros from another. See Figure 1, Case 3; not shown is the case where a new base is used and run Y = run X.

Run number(s). A run number is a five-digit number that automatically is incremented at the beginning of each linked run, and uniquely defines the run. If output is drawn from just one run, the *short* run number consists of the three right-most digits of the run number. If the output was a comparison of separate saved runs, a six-digit *short* run number will be used, consisting of the last three digits of the output "scenario" run number, followed by the last three digits of the output "base" or "reference" run number. At this time, room has not been found to include any new output "base" run number in table headings, or *short* run number in directory or file names.

FIGURE 1 -- LINKED RUNS MAP INTO THE OUTPUT "SCENARIO" AND "BASE"



File Names and Extensions

Example Directory and File. The names of CLS scenario or project directories begin with minus signs ("-"). Following is an example of the full path and name of a CLS results file:
Country Linked System information.
| Scenario: Baseline, to be published in 1998.
| | Scenario/Run number 01480; No overwrite of history by FAS PS&D data.
| | | Output form: Commodity print files.
| | | | Wheat print file.
| | | | |
H:\-BL98\480.NPS\Commod.Prn\WH_COM.PRN

File Name Extensions.
_____.DOC = Documentation, stored in a plain ASCII text file.
_____.PRN = Printable file. These could also be referred to as plain ASCII or text files. To print from WordPerfect 6.1, follow the instructions on page 12.
_____.CSV = Comma-Separated-Value file; can be imported into a spreadsheet or database. To load into Excel, Lotus 5, Lotus 3.1, or SuperCalc, follow the instructions beginning on page 13.
_____.TS = TS file; can be used by TS (Time Series or PS&D View) software.
_____.WPD = Documentation, stored in a WordPerfect 6.1 file.
_____.ZIP = File containing other, compressed files. Used with the PKUNZIP.EXE program.

ZIP File Names

The zipped (compressed) files are given coded names that contain a lot of information within up to eight characters.

First character. The first character of a .ZIP file name indicates the subject matter:
A = trade,
B = database,
D = commodity,
E = diagnostics,
H = mismatches between country/commodity coverage table and model results,
M = Armington trade matrices,
N = country,
R = reference prices, and
S = summary.

Second Character. The second character of a .ZIP file name indicates how the file can accessed:
P = Printable files,
T = TS files, and
V = CSV files.

Run Number. The .ZIP file names end with the *short* run number.

Drive and Projects

H:\ = Usual drive letter for CLS information on the LAN.

H:\-BL98\ = Project directory for the Baseline to be published and used in 1998; Baseline projections performed in 1997/98. Any minus signs (-) at the fronts of directory names indicate that the directories contain project run results.

H:\-BL98**-BL98.DOC** = Project documentation by short run number.

Run Directories

The examples below use the 1997/98 Baseline project and Run 480, or #01480, to be more precise. As with ZIP file names, the last 3 digits of the run number or run numbers are used.

H:\-BL98**480.PSD** = Results for run #01480. Scenario, base, percent differences. ALL commodities and aggregates are shown, along with the MAIN variables and aggregate variables. During the output step, Model history **overwritten** by FAS PS&D data, where available. Tables have "PS&D" in the upper-right corner.

H:\-BL98**480.NPS** = Results for run #01480. Scenario, base, percent differences. ALL commodities and aggregates are shown, along with the MAIN variables and aggregate variables. Model history **not** overwritten by FAS PS&D data during the output step.

H:\-BL98**480.PSF** = Results for run #01480. Scenario, base, percent differences, and differences; Full output. ALL commodities and aggregates are shown, along with MOST variables and aggregate variables. If disk space permits, results also may include scenario and base annual growth rates, and scenario and base annual changes. Again, if disk space permits, a given type of output (see sub-subdirectories below) may include all of the TS history years. During the output step, model history **overwritten** by FAS PS&D data where available. Tables have "PS&D" in the upper-right corner.

H:\-BL98\480.PSD**DP480.DOC** = Commodity documentation: codes (abbreviations) and raw PS&D file dates. Base year, etc.
H:\-BL98\480.PSD**NP480.Doc** = Country documentation: codes, country model dates, and regional aggregations. Base year, etc.

H:\-BL98**OLD** = Older run directories, zipped. These old results will be deleted to save space but are retained temporarily in case someone still wants them.

Commodity Files

Directories and files listed in this section are located within the **H:\-BL98\480.PSD** directory. Files in this section contain balance sheets with quantities and prices. There is a file for each commodity; within files, tables are organized by country.

...**COMMOD.CSV** = Directory for commodity CSV files.
...\COMMOD.CSV\WH_COM.CSV = Example commodity CSV file: wheat.
...\ZIPPED\DV480.ZIP = Compressed commodity CSV files.

...**COMMOD.PRN**\ = Directory for commodity print files.
...\COMMOD.PRN\WH_COM.PRN = Example commodity print file: wheat.
...\ZIPPED\DP480.ZIP = Compressed commodity print files.

...**COMMOD.TS**\ = Directory for commodity TS files.
...\COMMOD.TS\WH_COM.TS = Example commodity TS file: wheat.
...\ZIPPED\DT480.ZIP = Compressed commodity TS files.

To the right of each country name in a TS file is a 4-character code for the type of comparison shown (see page 3); "All0" indicates an empty table.

Country Files

Directories and files listed in this section are located within the **H:\-BL98\480.PSD** directory. Files in this section contain balance sheets with quantities and prices. There is a file for each country; within files, tables are organized by commodity.

...**COUNTRY.CSV**\ = Directory for country CSV files.
...\COUNTRY.CSV\ARG_CTR.CSV = Example country CSV file: Argentina.
...\ZIPPED\NV480.ZIP = Compressed country CSV files.

...**COUNTRY.PRN**\ = Directory for country print files.
...\COUNTRY.PRN\ARG_CTR.PRN = Example country print file: Argentina.
...\ZIPPED\NP480.ZIP = Compressed country print files.

...**COUNTRY.TS**\ = Directory for country TS files.
...\COUNTRY.TS\ARG_CTR.TS = Example country TS file: Argentina.
...\ZIPPED\NT480.ZIP = Compressed country TS files.

The variable headings in TS cannot be tailored to every commodity. The headings for corn are used for all commodities. The year headings are appropriate for the crops, but sugar and animal products are shown on a crop year basis. For example, calendar year 1991 pork data are listed under crop year 1990/91. To the right of each commodity name in a TS file is a 4-character code for the type of comparison shown (see page 3); "All0" indicates an empty table.

Price Files

Directories and files listed in this section are located within the **H:\-BL98\480.PSD** directory.
...**REFPRICE.CSV**\ = Directory for country price CSV files.
...\REFPRICE.CSV\ARG_PRIC.CSV = Example country price CSV file: ARGENTINA.
...\ZIPPED\RV480.ZIP = Compressed country price CSV files.

Reference prices and variables shocked by the linker. There is a file for each country; within files, tables are organized by scenario and base. The scenario prices and any variables shocked by the linker can be imported into a country spreadsheet and copied to the appropriate locations. After recalculation, the spreadsheet should reflect the scenario.

...**REFPRICE.PRN**\ = Directory for commodity price print files.
...\REFPRICE.PRN\WH_PRIC.PRN = Example commodity price print file: wheat.
...\ZIPPED\RP480.ZIP = Compressed commodity price print files.

Reference prices. There is a file for each commodity. Prices can be scanned to confirm that a model used the correct reference price series.

Trade Files

Directories and files listed in this section are located within the **H:\-BL98\480.PSD** directory. There is a file for each commodity.

...**TRADE.CSV** = Directory for CSV trade tables.
...\TRADE.CSV\WH_TRAD.CSV = Example CSV trade table: wheat.
...\ZIPPED\AV480.ZIP = Compressed CSV trade tables.

The tables below combine output "scenario" and output "base" data:

Exports and imports, thousand MT

1. Scenario Exports = $ScEx_t$
2. Scenario Imports = $ScIm_t$

3. Base Exports = $BaEx_t$
4. Base Imports = $BaIm_t$

5. Scen-Base Exports = $(ScEx_t - BaEx_t)$
6. Scen-Base Imports = $(ScIm_t - BaIm_t)$

The world value is obtained from the sum of country values. If some country model has an unusually high or low reference price (RP) series, that price will affect the country and world values calculated here.

Real values, thousand 1990 dollars.

7. Scen Export value = $ScEx_t * ScRP_t$
8. Scen Import value = $ScIm_t * ScRP_t$

9. Base Export value = $BaEx_t * BaRP_t$
10. Base Import value = $BaIm_t * BaRP_t$

11. Scen-Base Export value = $(ScEx_t * ScRP_t) - (BaEx_t * BaRP_t)$
12. Scen-Base Import value = $(ScIm_t * ScRP_t) - (BaIm_t * BaRP_t)$

Nominal values, thousand dollars. The U.S. GDP deflator is $\mathbf{Def_t}$.

13. Scen Export Value = $ScEx_t * ScRP_t * Def_t / 100$
14. Scen Import Value = $ScIm_t * ScRP_t * Def_t / 100$

15. Base Export Value = $BaEx_t * BaRP_t * Def_t / 100$
16. Base Import Value = $BaIm_t * BaRP_t * Def_t / 100$

17. Scen-Base Export Value = $[ScEx_t * ScRP_t - BaEx_t * BaRP_t] * Def_t / 100$
18. Scen-Base Import Value = $[ScIm_t * ScRP_t - BaIm_t * BaRP_t] * Def_t / 100$

Real prices, 1990 dollars/metric ton. For aggregate commodities, prices are weighted by trade (imports+exports). The world price here is NOT a weighted average of country prices; it is the standard reference price, adjusted by scenario movements in the U.S. price. Base reference prices are obtained from the country models, except for the U.S., ROW, Residual, Exogenous region, and World prices, which start with the standard reference prices.

19. Scen Reference Price, Real
20. Base Reference Price, Real

21. Scen Reference Price, Nominal
22. Base Reference Price, Nominal

Tables 23-25 would appear with H:\-BL98**480.NPS**\ output, which has no PS&D overwrite. In baseline mode, Table 24 shows the trade imbalances that cause world prices to move. Table 25 has special relevance when the base or reference portions of two runs in baseline mode are compared, where the runs differ only because different versions of the models are used; in

this unusual type of output, Table 25 shows the trade differences that cause world prices to differ between the Scenario portions of the two runs.

23. Scenario net export growth = $(ScEx_t - ScIm_t) - (ScEx_0 - ScIm_0)$
24. Base net export growth = $(BaEx_t - BaIm_t) - (BaEx_0 - BaIm_0)$
25. Scen-Base net export growth = $(ScEx_t - ScIm_t) - (ScEx_0 - ScIm_0) - [(BaEx_t - BaIm_t) - (BaEx_0 - BaIm_0)]$

...**TRADE.PRN**\ = Directory for printable trade tables.
...\TRADE.PRN\WH_TRAD.PRN = Example printable trade table: wheat.
...\ZIPPED\AP480.ZIP = Compressed printable trade tables.
Tables: see description for **TRADE.CSV**\, above.

Summary Files

Directories and files listed in this section are located within the **H:\-BL98\480.PSD**\ directory.
...\SUMMARY.PRN\ = Directory for summary print tables.
...\SUMMARY.PRN**SP480.AVG** = Multiple-year average trade imbalances, price changes, and quantity changes.
...\SUMMARY.PRN**SP480.IMB** = Imbalances between supply and use.
...\SUMMARY.PRN**SP480.PRI** = Yearly prices and changes from the reference run.
...\SUMMARY.PRN**SP480.RES** = Summary of residual region levels.
...\SUMMARY.PRN**SP480.TOT** = Any exogenous world production and exports.
...\ZIPPED\SP480.ZIP = ZIP file containing summary print tables.

...\SUMMARY.CSV**PRI_SV.CSV** = "World" reference prices, CSV.
...\ZIPPED\SV480.ZIP = ZIP file containing "World" reference prices, CSV.

Database Files

Directories and files listed in this section are located within the **H:\-BL98\480.PSD**\ directory.
...\DATABASE.CSV\ = Directory containing CSV files that may be imported into database software packages, to create database tables. An example database is available in H:\-BL98\480.PSD\DATABASE.CSV\. Database fields are listed below each file name that follows. This section could also have been placed under the description of the linker's databases, on page 27.

...\DATABASE.CSV**ACCDBASE.CSV** = Main database output file. Fields:

1. RUNNU = CLS run number for a given record.
2. SBNU = Number indicating scenario (=1) or base (=0) portion of original run.
3. CDNU = Commodity number.
4. CNNU = Country number.
5. VRNU = Variable number.
6. VRAXSW = Variable name exception switch ("*").
7. VRAX18 = Variable name, including any exception; 18-character field.
8. VRAX9A = Variable name, including any exception; part 1 of 2, 9-character field.
9. VRAX9B = Variable name, including any exception; part 2 of 2, 9-character field.
10. 92/93 = Data for crop year 1992/1993; corresponds to calendar year 1993.
11. 93/94 = Data for crop year 1993/1994; corresponds to calendar year 1994.

... other years ...

...\DATABASE.CSV**ACCNACD.CSV** = Commodity names. Macroeconomic variables, various other World prices, and other shock variables are grouped as though they constituted commodity blocks. Fields:

1. CDNU = Commodity number.
2. CDNA03 = Commodity code, 3-character field.
3. CDNA12 = Commodity name, 12-character field.
4. RUNNU = CLS run number used for output "scenario."
5. RUNNUB = CLS run number used for output "base."

...\DATABASE.CSV**ACCNACN.CSV** = Country names. Fields:

1. CNNU = Country number.
2. CNNA03 = Root country code, 3-character field.
3. CNNA06 = Country code with Baseline year interval (8 = 1997/98) and scenario letter, in a 6-character field.
4. CNNA24 = Full country name, 24-character field.
5. RUNNU = CLS run number used for output "scenario."
6. RUNNUB = CLS run number used for output "base."

...\DATABASE.CSV**ACCNASB.CSV** = Scenario/Base titles. Fields:

1. SBNU = Number indicating scenario (=1) or base (=0) from original run.
2. SBNA01 = Scenario or Base designation, 1-character field.
3. SBNA02 = Scenario or Base designation, 2-character field.
4. SBNA04 = Scenario or Base designation, 4-character field.
5. SBNA08 = Scenario or Base designation, 8-character field.

...\DATABASE.CSV**ACCNAVR.CSV** = Variable names. Fields:

1. CDNU = Commodity number.
2. VRNU = Variable number.
3. VRNA03 = Variable name, 3-character field.
4. VRNA18 = Variable name, 18-character field.
5. VRNA9A = Variable name; part 1 of 2, 7 characters in a 9-character field.
6. VRNA9B = Variable name; part 2 of 2, 7 characters in a 9-character field.
7. CDNA03 = Commodity name, 3-character field.
8. RUNNU = CLS run number used for output "scenario."
9. RUNNUB = CLS run number used for output "base."

...\DATABASE.CSV**ACCXPVR.CSV** = Exceptions to variable names. Fields:

1. CNNU = Country number.
2. CDNU = Commodity number.
3. VRNU = Variable number.
4. VRNA03 = Variable name, 3-character field.
5. VRNA18 = Variable name, 18-character field.
6. VRNA9A = Variable name; part 1 of 2, 7 characters in a 9-character field.
7. VRNA9B = Variable name; part 2 of 2, 7 characters in a 9-character field.
8. CDNA03 = Commodity name, 3-character field.
9. RUNNU = CLS run number used for output "scenario."
10. RUNNUB = CLS run number used for output "base."

Other LAN Directories and Files

The LAN is used to store other CLS information, both input to the system and output from the system. Selected directories and files are listed below.

Diagnostics

The linker's conversion and run processing make available information on the operation of the individual foreign country models. This information may be used when understanding or debugging the models.

H:\DIAGNOST\	=	Main diagnostics directory, with indicators and possible problems in models. The remaining directories and files in this section are located within the **H:\DIAGNOST** directory.
...\COMPARE\	=	Precision of model conversion.
...**ELAST**\	=	Matrices of elasticities with respect to world prices.
...**ELASTCHK**\	=	Possible elasticity problems, such as unexpected signs or large magnitudes.
...**EP**\	=	Model diagnostics, by country, printable: 1. quantities generated without direct link to world price, 2. negative levels, 3. huge numbers, 4. supply ≠ use, 5. beginning stocks$_t$ ≠ ending stocks$_{t-1}$, 6. area * yield ≠ production, 7. total consumption ≠ food + feed + industrial + other use.
...\EP\-**EP.DOC**	=	Documentation for EP\ diagnostics.
...**FORMCHNG**\	=	Equations change form across years.
...**HP**\	=	Apparent mismatches between data table in H:\INPUT.LNK\DATA_AGG.CFL, versus linkable country coverage; commodity in country expected but not found, or found but not expected.
...**LEADS**\	=	If the present depends on the future, list cells.
...**LINKTABL**\	=	Tabulation of links to country by commodity and variable: requested or not; and possible or not, with reason (no variable name, invalid address, ERROR, N/A, missing years, or all zero but not trade).
...\LINKTABL\-**LINKTBL.DOC**	=	Signs, numbers, and codes (abbreviations) in link tables.
...**NONREP**\	=	Non-repeatable results by country, commodity, and linked variable.
...\SELFREF\	=	Variable on left- and right-hand side of same equation; often an endogenous domestic price that adjusts itself iteratively to reflect a trade restriction.
...**UNDEFINE**\	=	Use of undefined, blank or text cells.

Input

H:\INPUT.LNK\	=	Directory for copies of selected linker control files.
H:\INPUT.LNK**DEFSHOCK.CFL**	=	Definitions of links between reference prices and world markets, and definitions of other shock variables.
H:\INPUT.LNK**OUTPUT.CFL**	=	Linker output control file.

H:\INPUT.LNK**DATA_AGG.CFL** = PS&D data aggregation control file.

H:\98INOUT\ = Directory for country input data and output writeups.
H:\98INOUT**98PRICES**\ = Reference prices.
H:\98INOUT**98TSFILE**\ = PS&D data in TS files; used to update country models.
H:\98INOUT**98WRITE.UPS**\ = Country writeups for Baseline.

Other Directories

H:\EUINTRA\ = Intra-European Union trade: Wheat, Rice, Coarse Grains.
H:\MODELS\ = Models being exchanged.
H:\PARAMETE.RS\ = Model elasticities and trend growth rates.
H:\POP\ = Population.

Using CLS Output with Your Software

A few possible software packages are listed below. These packages are or were in common use in ERS.

Applications and Software

Task	Software
Manage files	Windows File Manager, NT Explorer, QFiler, WordPerfect, etc.
View print files	WordPerfect, List (for files up to 16MB), etc.
Print	WordPerfect
Manipulate numbers	Excel, Lotus 1-2-3, SuperCalc
View TS files	TS (current version)
Uncompress files	PKUNZIP (2.04g)
Use database files	Access, Paradox

Printing Tables with WordPerfect 6.1

(Example file: H:\-BL98\480.NTS\Country.Prn\MEX_CTR.PRN. This example applies to country and commodity tables.)

1. Use WordPerfect
2. File Open
   Drives H:
   Directories -BL98\480.NTS\Country.Prn
   Filename MEX_CTR.PRN
   OK
   Convert file format from ASCII (DOS) Text
   (Your access may be read-only; that is OK.)
3. Format
   Font Line printer
   Page Paper Size Letter Landscape
   Margins Left .200" Right .200" Top .167" Bottom .273"
4. Move cursor down a couple of pages to verify that page breaks are consistently above table titles. If not, adjust top or bottom margin.
5. File Print (Use a Series 4 printer or higher, if possible.)

Importing CSV Files into Excel

(Example file: H:\-BL98\480.NTS\Country.CSV\MEX_CTR.CSV)

1. Use Excel
2. File Open
   File type Text
   Look in H:
   select -BL98 then 480.NTS then Country.CSV then MEX_CTR.CSV
   Open
   (Your access may be read-only; that is OK.)

Importing CSV Files into Lotus 5

(Example file: H:\-BL98\480.NTS\Country.CSV\MEX_CTR.CSV)

1. Use Lotus 5
2. File Open
   File type Text
   Drives H:
   Directories -BL98\480.NTS\Country.CSV
   Filename MEX_CTR.CSV
   OK
   (Your access may be read-only; that is OK.)

Importing CSV Files into Lotus 3.1

(Example file: H:\-BL98\480.NTS\Country.CSV\MEX_CTR.CSV)
/ File Import Numbers H:\-BL98\480.NTS\Country.CSV\MEX_CTR.CSV

Importing CSV Files into SuperCalc

(Example file: H:\-BL98\480.NTS\Country.CSV\MEX_CTR.CSV)
// Import Csv H:\-BL98\480.NTS\Country.CSV\MEX_CTR.CSV

Linked System Coverage

The following linked system coverage tables give an impression of the extent of the links to the models. However, some models do not have all commodities or variables. On the other hand, models may have commodities or variables that are not linked.

Regional/Country Models

There are 46 regional or country models, including the U.S. and Other regional models, and 3 additional regions used for closure or scenarios (the rest-of-world, residual region, and exogenous region).

Algeria
Argentina
Australia
Bangladesh
Brazil
Canada
Central Amer. and Caribbean
China
Czech Republic
Egypt

European Union-15
Hong Kong
Hungary
India
Indonesia
Iran
Iraq
Japan
Malaysia
Mexico
Morocco
Myanmar (Burma)
New Zealand
Pakistan
Philippines
Poland
Russia
Saudi Arabia
Slovakia
South Africa, Republic of
South Korea
Taiwan
Thailand
Tunisia
Turkey
Ukraine
United States (USA)
Vietnam
West African, Franc Zone

Other Asia
Other Central and Eastern Europe
Other Former Soviet Union
Other North Africa and Middle East
Other South America
Other Sub-Saharan Africa
Other Western Europe

Rest-of-world
Residual region
Exogenous region

Commodities with World Market-Clearing Prices

The linked system clears 24 world commodity markets, using endogenous world prices.

Corn
Sorghum
Barley
Other coarse grains

Wheat
Rice

Cotton
Sugar

Beef and veal
Pork
Poultry meat
Eggs

Soybeans
Rapeseed
Sunseed
Other oilseeds -- the linker may sum Copra, Cottonseed, Groundnuts, and Sesame seed.

Soymeal
Rapemeal
Sunmeal
Other oil meals -- the linker may sum Copra meal, Cottonseed meal, Fish meal, Groundnut meal, and Sesame meal.

Soyoil
Rapeoil
Sunoil
Other oils -- the linker may sum Coconut oil, Cottonseed oil, Groundnut oil, Palm oil, Sesame oil, and Other tropical oils.

Other World Prices

In addition to the 24 world markets that the linker clears, 25 *other* world prices are moved in proportion to the 24 main world market prices, in order to keep price ratios approximately in line. The following example involves setting the price of cassava, whose market is not cleared, given the corn scenario/base price ratio and the original cassava price, all for a given year:

$$P_{CASSAVA,SCEN,t} = P_{CASSAVA,BASE,t} * P_{CORN,SCEN,t} / P_{CORN,BASE,t}$$

Other prices set:	Main market price:
Cassava (manioc)	Corn
Coarse grains	Corn
Other energy	Corn
Japonica rice	Rice
Total oilseeds	Soybeans
Copra	Other oilseeds
Cottonseed	Other oilseeds
Peanuts (groundnuts)	Other oilseeds
Total meals	Soymeal
Copra meal	Other meals
Corn gluten feed	Other meals
Cottonseed meal	Other meals
Fish meal	Other meals
Groundnut meal	Other meals
Other protein	Other meals
Total oils	Soyoil
Coconut oil	Other oils
Cottonseed oil	Other oils
Groundnut oil	Other oils
Palm oil	Other oils
Tropical oils	Other oils
Tropical oils, other	Other oils
Cattle	Beef and veal
Lamb and mutton	Beef and veal
Hogs	Pork

Variables Typically Linked

The linked system routinely links to 25 country/regional model variables for printing, to the extent that the variables are present and linkable. Other variables may be explicitly linked as needed; for example, in the U.S. and European Union-15 models.

Beginning stocks	Reference price (world price)
Area	Border price
Yield	Import price
Production	Export price
Imports	
Exports	Consumer price
Total consumption	Producer price
Food use	Government consumer price
Feed use	Government producer price
Industrial use	
Other use	Ad valorem import tax
Ending stocks	Specific (unit, flat) import tax

Ad valorem export tax
Specific (unit, flat) export tax

Marketing margin

Macroeconomic Variables Linked

Links may be made to 16 macroeconomic variables; additional variables could linked.

Population

GDP
GDP per capita
Consumption expenditure
Private consumption expenditure
Private consumption expenditure per capita
Private consumption expenditure per capita, rural
Industrial country GDP
Investment

Nominal exchange rate
Real exchange rate

Domestic GDP deflator
Domestic CPI
CPI fuel
Wage rate
Interest rate

Linker Databases, Tables, and Fields

The following portions of this report will be of use to the reader who wishes to operate the linker. The variety of controls listed in this section has resulted from the needs of the various users and projects with which the CLS has been involved.

The linker is controlled by data in files that are arranged in database format; that is, each observation is uniquely defined by parameters in fields in the same record or row. Database format is also used for much of the exogenous data provided to the linker. Database format simplifies processing of the control data and exogenous data, and makes it easier to keep track of what is going on. The linker uses many of the database tables as relational databases; that is, information in two or more tables may be linked through a field or fields that are common to the tables. The linker can also provide results in database-formatted CSV files.

The files listed in this section correspond to databases, in relational database terminology. Within each file/database are defined the linker variables (arrays or scalars); the arrays correspond to tables within a relational database. Finally, for each linker variable/table are defined the subscripts and levels; these correspond to fields in a relational database (or columns in a spreadsheet). The order of rows in the tables may determine the order of output, etc. The file/databases below are roughly associated with five topics: conversion/extraction, data, shocks, linked runs, and output; however, some file/databases contribute to more than one category. Where control file scalars are adjacent, they are grouped together as though they were in tables of scalars, to make it easier to view the material.

Countries, Variables, and Link Switches (XLFORT.XLS and SCFORT.CAL)

The data in \SCFORT\EXCEL\XLFORT.XLS and \SCFORT\CAL\SCFORT.CAL, and data extracted from the models by macros in these files, are used during conversion.

The nine country definition tables or variables have a transposed, horizontal organization, so there is only one record per table, but there is a field for each country.

Country Run Name. The name consists of a standard 3-character country code plus a 1-digit baseline year plus a 1-character scenario designation.
Output Directory. The directory holds extraction results.
Full Country Name. The 24-character name is used for output tables.
Country File Directory. The directory holds the spreadsheet model.
Country File Name. The file extension .XLS is assumed for Excel, and .CAL for SuperCalc.
Base Year Column Number. The base year column must be specified for SuperCalc models or Lotus 1-2-3 models converted to SuperCalc; Excel models provide the base year column number to the Excel Basic extraction macro.
Date/Time of Original File. This essential documentation is entered by hand.
Date/Time of Any Modified File. This essential documentation is entered by hand. A file might be modified to correct a problem, or to convert it from Lotus 1-2-3 to SuperCalc.
Extraction Switch. If this switch is > 0 for a model, then the model's contents will be extracted.
The nine country definition tables above all have a field for each country:
1. Definition for first country.

... Definitions for other countries ...

Variables and Link Switches. Linked system variable definitions and country/commodity/variable link/unlink switches. The link switches are in a 2-dimensional spreadsheet table or array to allow easy addition, removal, or change of range names and of countries. Fields:
1. Range name.
2. Commodity code.
3. Variable code or number.
4. Link switch for a given country. The country is specified by the country definition table above for the same column/field. A switch≥0 means link, while a switch<0 means unlink.

... Other countries ...

Conversion Switches (SCFORT.CFL)

If a country's code (abbreviation) is not found in \SCFORT\SCFORT.CFL during conversion, the switches implicitly are set to 0 for that country. Fields:
1. Full country code (including Baseline year code and scenario code).
2. ICNVSW = (0/1): Convergence diagnostic switch; if = 1, print levels of simultaneous (circular) block variables that do not converge, when the country subroutine is called. Turning ICNVSW on makes the converted model larger and slower.
3. IBASOF = Base year column offset, which allows selection of a new base year without redoing extraction or editing \SCFORT\CY_____C.SCF.
4. Model spreadsheet package (Lotus = 0, SuperCalc = 1, Excel=2).

(5. Row (0) or Column (1) arrangement of variables in model. Currently unused.)

6. IVDUMP = (0/1): if switch = 1, **COMPSUB**.BAT will dump levels of circular block variables, by iteration, into the file \SCFORT\DUMPVAR.BIN.

Definitions of Shocks and Reference Price Links (DEFSHOCK.CFL)

The data in \SCFORT\DEFSHOCK.CFL are used during conversion.

DTOXV. Table of shock variable definitions, specified by the following fields:
1. Country code or "ALL."
2. Range name, up to 20 characters.
3. Operator: Replace ("R"), Add ("A"), or Multiply ("M").

4. Time: start with Current ("C") or Lagged ("L") level, or null ("-") if the Operator is "R."
5. Source: start with Scenario ("S") or Base ("B") level, or null ("-") if the Operator is "R."
6. Crop year or "ALL."
7. Column offset.
8. Country code for direct link to variable in another model, or null ("-") for same model.
9. Commodity code for direct link to variable in another model, or null ("-") for same model.
10. Variable code for direct link to variable in another model, or null ("-") for same model.

REFPRI. Table of reference price links to commodity markets that are cleared by the linker. For example, both the Pork and Hog reference prices are tied to the Pork market. Fields:
1. Country code or "ALL."
2. Reference price range name, up to 20 characters.
3. Commodity code for the equilibrated world market.

PS&D Data Aggregation Parameters (DATA_AGG.CFL)

Data in \FAPSIM\ROWTREND\DATA_AGG.CFL control PS&D data aggregation and help to control linked runs and the output step. This file contains several relational datasets that define commodities, countries/regions, variables, and data aggregations, both generic and exceptions. Raw PS&D data are extracted from TS files. Output is to the linker or to datasets that are input to the country models.

NTDDEF. The input commodity definition database relates the
1. input commodity code, 3-character;
2. input commodity name in TS file, 25-character;
3. input .TS and .TXT data file name, 8-character;
4. year offset to convert calendar year data (sugar, animals, and animal products) to crop years; and
5. first year for trend regressions.

NCDN25. The output commodity name database implicitly determines the output commodity order and relates the
1. output commodity code, 3-character; and
2. output commodity name, 25-character, used in TS files.

NCDAGG. The generic commodity aggregation database relates the
1. input commodity code, 3-character;
2. output commodity code, 3-character; and
3. aggregation weight, +1.0 or -1.0.

NVRN14. The input variable name table relates the
1. input commodity code, 3-character;
2. variable code, currently 2-character; and
3. input variable name, 14-character, in input TS .TXT files.

NVRN2. The output variable name table implicitly determines the output variable order and relates the
1. variable code, currently 2-character; and
2. output variable name, 14-character, used in output TS files.

NTNRGN. The input/output country/region definition database relates the
1. output region code, 3-character;
2. internal unique country code used to store and retrieve data, 5-character; and
3. input 28-character country name used in the TS .TXT file.

NCNN25. The output country/region name database relates the
1. output region codes, 3-character; and
2. output region names, 25-character, for output TS files.

NACD01, NACD02, NACD03. Output commodity. Horizontal layout; same commodity fields/columns used in NOTHRG.
1. Commodity code

... Codes for other commodities ...

NCDDL1, NCDDL2, NCDDL3. Default output commodity. Horizontal layout; same commodity fields/columns used in NOTHRG.
1. Commodity code

... Codes for other default commodities ...

NOTHRG. The output coverage exceptions table is arranged by commodities in fields/columns, and regions in records/rows. There are four vectors surrounding the two-dimensional matrix in the body of NOTHRG; they are NAOTRG, NDOTRG, NACD01:3, and NCDDL1:3. The table looks like a bordered matrix. Fields:
1. NAOTRG = output country/region code, 3-character.
2. NDOTRG = output default country/region code, 3-character.
3. Switch for a given commodity. "+" indicates coverage, ">" indicates use of the default commodity, and "·" indicates use of the default region. The commodity for the field is indicated by NACD01:3, discussed above. The default commodity is indicated by NCDDL1:3, discussed above.

... Switches for other commodities ...

PS&D Data from FAS

USDA Foreign Agriculture Service (FAS) PS&D data are obtained from TS files, which are not in database format. The TS files can be converted to ASCII .TXT files. The dimensions are:
1. Commodity
2. Country
3. Variable
4. Year
5. Quantity.

Optional World Production and Exports (TOTPRD.CFL)

This file, \FAPSIM\INPUT\TOTPRD.CFL, contains optional exogenous world production and export totals that may be used in the reference or base portion of a linked run. These data should be specified in the initialization and projected years for Other coarse grains, Other oilseeds, Other meals, and Other oils, where totals might otherwise be subject to double-counting. For example, this problem arises for Other coarse grains because in some models, data for corn, sorghum, or barley may fall into Other coarse grains. Initialization year

estimates for the World for the Other commodities may be obtained from \FAPSIM\ROWTREND\ROWAGG.OUT.

Projected data for total grains, wheat, rice, coarse grains, corn, sorghum, barley, cotton, soybeans, soymeal, and soyoil may be available from the most recent Baseline, through Paul Westcott. Ensure that any exogenous world totals are consistent with the model projections in using European Union and Former Soviet Union extra-region trade or total trade. Estimates of initialization year production and exports for the rest of the commodities sometimes are obtained from Rip Landes.

In post-baseline mode, any exogenous totals are used in the initialization year, and for projected years as well. In baseline mode, any exogenous totals are used in the initialization year, but not in the projected years (see IFCSSW on page 24 and the residual region on page 47).

1. Variable, either production ("PR") or exports ("EX").
2. Crop year.
3. Exogenous total.

Population Aggregation (POP.CFL)

Data in \FAPSIM\POP\POP.CFL control aggregation of country population numbers into regional totals. This population aggregation step may be more thoroughly integrated into the linked system in the future.

1. Country code, 3-character.
2. Country name, 35-character.

Rest-Of-World Parameters (ROWPARM.CFL)

The rest-of-world parameters in \FAPSIM\INPUT\ROWPARM.CFL are used during linking. The tables in this section either are in matrix format or in transposed format. Commodities whose prices are shocked are implied by the fields/columns, and documented in NCDN3I. Only the first commodity field is listed; the remaining fields/columns are implied by ellipsis ("...").

NCDN3I. Commodity codes by columns; allow verification of correct column order for the other variables. Fields:

1 ... Code for first commodity ...

RELPRD. Elasticities of production, obtained from SWOPSIM (Sullivan, Roningen, Leetmaa, and Gray; 1992). The SWOPSIM elasticities are multiplied by 0.6 and further adjusted in the case of additional oilseeds and products.

1. Commodity code; a given record shows how the quantity of the given commodity responds to a shock to the price of a commodity in a particular field or column.

2 ... Elasticity for first commodity ...

RELDEM. Elasticities of demand, obtained from SWOPSIM (Sullivan, Roningen, Leetmaa, and Gray; 1992). The SWOPSIM elasticities are multiplied by 0.9 and further adjusted in the case of additional oilseeds and products.

1. Commodity code; a given record shows how the quantity of the given commodity responds to a shock to the price of a commodity in a particular field or column.

2 ... Elasticity for first commodity ...

RESPRD. Elasticities of price transmission for production.
1 ... Elasticity for first commodity ...

RESDEM. Elasticities of price transmission for demand.
1... Elasticity for first commodity ...

(*RTURES*. Linear combination parameter = 1.0 if trade is residual, and = 0.0 if demand is residual. Currently = 1.0 for all commodities; this variable may be dropped.
1... Parameter for first commodity ...)

(*REQTNS*. Fraction of endogenous deviation from trend production that is incorporated into basis for future trend; currently = 1.0 for all commodities; this variable may be dropped.
1... Fraction for first commodity ...)

(*REQTNU*. Fraction of endogenous deviation from trend demand that is incorporated into basis for future trend; currently = 1.0 for all commodities; this variable may be dropped.
1... Fraction for first commodity ...)

(*REXLIS*. Linear combination parameter = 1.0 if production growth is exponential or = 0.0 if growth is linear; currently = 0.0 for all commodities; this variable may be dropped.
1... Parameter for first commodity ...)

(*REXLIU*. Linear combination parameter = 1.0 if demand growth is exponential or = 0.0 if growth is linear; currently = 0.0 for all commodities; this variable may be dropped.
1... Parameter for first commodity ...)

RGTOTP. Annual growth rate in reference prices, 1978-present; percent.
1... Growth rate for first commodity ...

RGTOTS. Annual growth rate in production, 1978-present; percent.
1... Growth rate for first commodity ...

RGTOTU. Annual growth rate in demand, 1978-present; percent.
1... Growth rate for first commodity ...

RELINC. Income elasticity of food demand per capita.
1... Elasticity for first commodity ...

RFRFOO. Fraction of total demand used for food.
1... Fraction for first commodity ...

Scalars.
1. RGRINC = Annual growth rate in ROW income; currently guesstimate; affects overall run.
2. RGRPOP = Annual growth rate in ROW population; currently guesstimate; affects overall run.
3. RY0INC = ROW initial income level index; currently arbitrary; does not affect overall run.
4. RY0POP = ROW initial population level index; currently arbitrary; does not affect overall run.

Price Levels and Ratios, and GDP Deflator (PRICES.CFL)

Data in \FAPSIM\INPUT\PRICES.CFL help to initialize linked runs, and may introduce "shocks" in the form of exogenous world price ratios.

CYPXOG. Any exogenous price ratios.
1. Commodity code.
2. Crop year
3. Exogenous ratio = Reference Price $_{SCENARIO,t}$ / Reference Price $_{BASE,t}$

GDPDEF. U.S. GDP deflator.
1. Crop year
2. Deflator

CYPRPW. Historical and projected reference prices.
1. Commodity code.
2. Crop year
3. Real:nominal transformation (generally real-to-real, or no change.)
4. Reference price

Shock Levels (CYS_____.CFL)

The linker may introduce shocks to models during the scenario step of a run, given data in a \FAPSIM\INPUT\CYS_____.CFL file, which is referred to in \FAPSIM\INPUT\FAPFILE. If no shocks should be introduced during a run, refer to the CYSETNUL.CFL null shock file. Note that the fields for DTOXV in \SCFORT\DEFSHOCK.CFL match those for SETOXV, except for the level of the shock.

SETOXV. Table of shock variable levels, specified by the following fields:
1. Country code or "ALL."
2. Range name, up to 20 characters.
3. Operator: Replace ("R"), Add ("A"), or Multiply ("M").
4. Time: start with Current ("C") or Lagged ("L") level, or null ("-") if the Operator is "R."
5. Source: start with Scenario ("S") or Base ("B") level, or null ("-") if the Operator is "R."
6. Crop year or "ALL."
7. Column offset.
8. Country code for direct link to variable in another model, or null ("-") for same model.
9. Commodity code for direct link to variable in another model, or null ("-") for same model.
10. Variable code for direct link to variable in another model, or null ("-") for same model.
11. Level of shock variable.

Armington Input (ARMINGTN.CFL)

The Armington control file, \FAPSIM\INPUT\ARMINGTN.CFL, is used during a linked run.

SIGMA. Default elasticity of substitution for all importers and commodities; scalar.

SIGMIL. Table of exceptions to SIGMA, specified by the following fields:
1. Importing Country, 3-character code
2. Commodity code.
3. Elasticity of substitution.

XILJ. Table of bilateral trade matrix elements, specified by the following fields:
1. Importing Country, 3-character code
2. Exporting Country, 3-character code
3. Commodity code.
4. Bilateral trade level, historical.

BXAR. Table of bilateral tariff multipliers introduced during a scenario; the fields are:
1. Importing country, 3-character code
2. Exporting country, 3-character code
3. Commodity code.
4. Tariff type: Import or export tax, ad-valorem or specific/unit.
(5. Scenario/Base; in the past, the Base could be endogenous. This field should be dropped, and all multipliers applied to the Scenario only.)
6. Bilateral tariff levels as fractions of the full tariff levels, for first year.

... Tariff levels for other years ...

Exogenous Region Shocks (EXOG_RGN.CFL)

The shocks specified in \FAPSIM\INPUT\EXOG_RGN.CFL are assigned directly to exogenous region production or consumption during a scenario; exogenous region imports and exports are implied.
1. Commodity code.
2. Crop year.
3. Code for variable to be shocked; production ("PR") or demand ("DM").
4. Level in thousand metric tons.

Country Link List (CTR_LIST.CFL)

The country model versions listed in \FAPSIM\INPUT\CTR_LIST.CFL will be used in the next linked run if **LOADFAPL**, **LOADREXL**, **NEWCYL**, or **CTR_MAKL** is invoked.

IVERSB. (1/2): if IVERSB=1, use only one model version for both scenario and base; that version is listed in the first field of NCTRSB. If IVERSB=2, use the model version listed in the first field of NCTRSB for the base or reference run, and the model version listed in the second field of NCTRSB for the scenario. Scalar.

NCTRSB. File names of country model versions to link. Fields:
1. Country model version to use for the base or reference run. If IVERSB=1 or if the second field is empty, also use this version for the scenario. Example model version: "CHN8A."
2. Country model version to use for the scenario if IVERSB=2. If this field is empty, the entry for the first field will be used.

Run Years, Switches, and Documentation (PROJYR.CFL)

Parameters from \FAPSIM\INPUT\PROJYR.CFL are used during conversion, PS&D data aggregation, linking, and generation of output.

Scalars.
1. IYRBEG = First history year captured from country model. Crop year.
2. IYRBAS = Base year, usually last exogenous year. Crop year.

3. IYREND = Last projection year. Crop year. IYREND must be at least 2 greater than IYRBAS.
4. LINKSW = 1 if linked run; otherwise = 0.
5. IARMSW = 1 if Armington trade pattern, price adjustment, and tariff adjustment are to be invoked; otherwise = 0.
6. IELASW = 1 if implied elasticities are to be calculated for Foreign and ROW; otherwise IELASW=0.
7. IYRELB = First year for elasticities or dump of simultaneous variables by iteration. Relative year.
8. IYRELL = Number of elasticity lags.
9. IYROFS = Year offset.
   = 0 for no intentional misalignment of Fapsim and foreign years.
   = 2 for example: in Taiwan pork and S.E. Asian crises, the real-world scenario began 2 years before the foreign models were endogenous. Therefore, Fapsim 1997/98 was aligned with foreign 1999/00 and Fapsim 1997/98 was printed as CLS USA 1999/00. Foreign 1997/98 shocks had to be applied to foreign models in 1999/00.
10. IFCSSW = Forecast switch.
   = 0 for post-Baseline mode. The reference run is set in balance with residuals in the initialization year *and projected years*, so the scenario run would be the same as the reference run in the absence of a shock. Residual region Production and Export add factors make Production and Exports match any exogenous Production and Export world totals, in the initialization year and projected years. Residual region Demand+stock change add factors make domestic use match domestic supply in the initialization year and projected years. Residual region Import add factors make Imports match Exports in the initialization year and projected years.
   = 1 for Baseline mode. The reference run is in balance in the initialization year but out of balance in the projected years. Residual region Production, Export, Demand+stock change, and Import add factors are set in the initialization year as for IFCSSW=0. The difference is that with IFCSSW=1, any initialization year residuals are reused in later years.
   = 2 for Baseline projections with add factors calculated from the previous Baseline project. IFCSSW=2 was not used for the 1994/95, 95/96, 96/97, or 97/98 Baseline projects. IFCSSW=2 would require models and price series that change only to the extent that markets change. At the moment, price series and models change for arbitrary reasons, such as changes in analysts or correction of mistakes.
   = 3 to discover endogenous U.S. prices given exogenous foreign trade. This approach doesn't work well with the soy complex, which is solved simultaneously. IFCSSW=3 has not been used much.
11. RUNDOC = Run documentation, 80-character field. Parentheses should be included in RUNDOC to separate it from the main table heading.

Fortran File Definitions

When a Fortran program opens a file for input or output, the program must assign a unit number to the file. The ASCII files listed below specify unit numbers for the input/output files, and set optional parameters for file deletion, formatting, access, and record length:
\FAPSIM\INPUT\FAPFILE (for linker runs with \BAT\FAPREXL.BAT)

\FAPSIM\INPUT\PRTFILE	(for repeating linker print/output step with \BAT\REPRTL.BAT)
\FAPSIM\ROWTREND\RAWTSF9	(for raw PS&D data processing with \BAT\9RAWTS.BAT)
\FAPSIM\ROWTREND\TSHIST9	(for PS&D history processing with \BAT\9TSHIST.BAT)
\FAPSIM\ROWTREND\TSTREN9	(for PS&D trends with \BAT\9TSTREND.BAT)
\FAPSIM\ROWTREND\ROWAGG9	(for aggregation of PS&D trends with \BAT\9ROWAGG.BAT)
\FAPSIM\POP\POPRAW9	(for aggregating population with \BAT\9POPRAW.BAT)
\SCFORT\CY\SCFFILE	(file names, unit numbers, etc., for use with \BAT\SCFORT9.BAT, which calls \SCFORT\CY\SCFILE.BAT, which creates SCFFILE.)

Optional Fapsim Convergence Criteria (YYTOL.DAT)

\FAPSIM\INPUT\YYTOL.DAT contains optional variable-specific convergence criteria for Fapsim, used in \FAPSIM\SOLVE.F to override defaults during a linked run.

1. YY variable number.
2. Relative tolerance level.
3. Absolute tolerance level.

Output Control Parameters (OUTPUT.CFL)

\FAPSIM\INPUT\OUTPUT.CFL controls the output step that occurs at the end of each linked run. The output step may also be invoked separately (see page 39).

Scalars for All Output. The first five switches (NTSPSW, NSBRUY, NSBRUX, NSBRUN, and NEWBAS) affect all output tables.

1. NTSPSW = (0/1) If 1, FAS PS&D data, where available, overwrite model results in output step.
2. NSBRUY = When reprinting, use the scenario ("SC") or base ("BA") part of input run Y as the output "scenario." If the input run numbers are the same, NSBRUY="SC," regardless of the setting in this database file. If the input run numbers are unequal, usually set NSBRUY="SC."
3. NSBRUX = When reprinting, use the scenario ("SC") or base ("BA") part of input run X as the output "base." If the input run numbers are the same, NSBRUX="BA," regardless of the setting in this database file. If the input run numbers are unequal, usually set NSBRUX="SC."
4. NSBRUN = Reprint: if NEWBAS = 1, use this parameter to select the original scenario ("SC") or base ("BA") from run N to be the new output base.
5. NEWBAS = (0/1) If NEWBAS=1 and the output step is being rerun, then the output step uses a new base run, automatically taking the Scenario-Base from the first pair of runs and correcting any year offset from the first pair of runs (see page 3).

Scalars for Other Output. The next three settings (NYRAVG, NACCDB, and NMNYTR) do not affect the country or commodity output tables.

1. NYRAVG = Number of years to group in summary averages tables.
2. NACCDB = (0/1) If 1, create \ACCESS\ACC___.CSV files, database-importable.
3. NMNYTR = First crop year for trade tables. 9999 = IYRBEG. This option is not fully flexible currently because of a RAM constraint.

The remaining settings only affect the country and commodity output tables.

NRGN24. Table relating full region names to region codes.
1. Region code, 3-character
2. Region name, 24-character

NRGNCN. Table of regional aggregate definitions, for printing.
1. Region code, 3-character
2. Sign. Use a minus sign ("-") to subtract country data from the total or a space (" ") to add country data to the total.
3. Country code, 3-character; use "FLL" for an empty place-filler country with NALLTB=1.

NORDCN. Table specifying order of countries and regions to print in commodity files.
1. Country or region code, 3-character. The order of countries and regions in the commodity tables is implied by the order of NORDCN records. Countries not selected with NORDCN automatically are placed at the end of the output.

NORDCD. Table specifying order of commodities to print in country files.
1. Commodity code. If a commodity is not listed, it is not printed.
(2. Commodity name, 12-character. This field currently is unused because the 12-character commodity names may be needed before they are read from this file.)

NDPVTY. Table of first and last crop years to print. Implied defaults, by type of output.
1. Country ("N") or commodity ("D") tables.
2. Printable ("P"), importable comma-separated value ("V"), or TS ("T") format.
3. Comparison of results; Base = "BA," Scenario = "SC," Percent difference = "PC," etc. (see codes on page 3).
4. First crop year; for example, absolute (1997) or relative (0) or 9999 for first year available, which is 1960 if FAS PS&D data are to overwrite model numbers during output step.
5. Last crop year; for example, absolute (2010) or relative (13) or 9999 for last year available.

NORDLG. Comparisons to print: base, scenario, percent difference, etc. (see page 3).
1. Type of comparison. The order of output comparisons is implied by the order of NORDLG records.

NCLVR. Variables to be printed in each commodity table. There is a hierarchy of defaults, by commodity. The order of columns in the output is implied by the order of NCLVR records.
1. Commodity code.
2. Table number. Usually = 1 unless the table is continued; currently continued only for Other Prices (P2).
3. Variable number.

NVRHED. Variable names, by commodity. There is a hierarchy of defaults, by commodity.
1. Commodity code.
2. Variable number
3. Variable name, 2-row; paired 9-character fields containing 7-character headings.
4. Variable name, 18-character.

NVRDF. Re-defined column/variable headings in country and commodity tables.
1. Country code, 3-character.
2. Commodity code.

3. Variable number
4. New variable name, 2-row; paired 9-character fields containing 7-character headings.
5. New variable name, 18-character.

NFRDF. Optional footnotes for country and commodity tables.
1. Country code, 3-character.
2. Commodity code.
3. Footnote text, up to 175 characters.

Scalars for Country/Commodity Output.
1. NALLTB = (0/1) If 0, only print tables with data (own reference price doesn't count).
2. NDBCOL = (0/1) If 1, put database columns in CSV output.
3. NGRCSV = (0/1) If 1, include growth rates at bottom of CSV tables.
4. NPGROW = Number of blank lines above percent growth row in printed and CSV output.
5. NPBELO = Number of blank lines below country/commodity block in printed and CSV output.
6. NXLINE = Number of blank lines above each CSV table.

CLS Database Output

The directory for these files is \ACCESS\ until the files are copied to the LAN. This directory holds CLS output that can be imported into database software packages. The files are described in the section on database output files, page 9.

Other Linker Directories and Files

Listed below are selected directories and files used during operation of the linker. The linker consists of Fortran programs, Visual Basic programs in Excel, .BAT files, SuperCalc macros, and data files.

Batch Commands

\BAT\	This directory for batch files should be specified in the PATH statement. The directory (\BAT\) and extension (.BAT) are not displayed for the batch programs in this section because only the program name and any parameters need be typed. An "L" at the end of a .BAT file name represents the Fortran 77 compiler, as opposed to "9" at the beginning or end of a .BAT file name, for the Fortran 90 compiler.
9COLHED	Get column headings/TS variable names from TS .TXT files, for use in \FAPSIM\ROWTREND\DATA_AGG.CFL, table/variable NVRN14.
9TSALL	Aggregate FAS PS&D data for CLS and calculate trends.
NEWSCF9	Run FSS9 SCFORT and LOADSCF9.
LOADSCF9	Create SCFORT.EXE.
SCFORT9	Create \SCFORT\CY\SCFFILE, run SCFORT.EXE to convert one country spreadsheet model to FORTRAN, and run COMPSUB.
SCF9	Run SCFORT9 for a list of countries.
COMPSUB	Run conversion diagnostic step. Usually called by SCFORT9.

FSCL	Compile Fortran files for a specified country in \SCFORT\CY\.
FSSL	Compile a specified Fortran file in \SCFORT\.
DIAGTOH	If the computer was not connected to the LAN during conversion, you should run **DIAGTOH** when the computer is next logged on to the LAN, in order to put new diagnostics on H:\. Sometimes when the diagnostics files are copied from \SCFORT\ to H:\DIAGNOST\ by SCFORT9, the dates of the files in H:\DIAGNOST\ aren't updated, although the contents are. DIAGTOH updates the file dates in H:\DIAGNOST\.
DUMPREA9	Examine behavior of simultaneous or circular blocks in models after you set IVDUMP=1 in \SCFORT\SCFORT.CFL, set IYRELB (the year to be examined) in \FAPSIM\INPUT\PROJYR.CFL, and run **COMPSUB**. IVDUMP=1 makes COMPSUB write to \SCFORT\DUMPVAR.BIN. Analysis of iteration information in DUMPVAR.BIN is begun when you run **DUMPREA9**. Output is placed in \SCFORT\DUMPVAR.OUT.

FSL	Compile one or all (*) of the *.F* files in \FAPSIM\. For example, **FSL CYTRD**.
NEWCYL	Run FSL CYTRD and LOADREXL.
LOADREXL	Run LOADFAPL and FAPREXL.
LOADFAPL	Run CTR_MAKL and create FAPSIM.EXE. All converting and compiling should be done first.
CTR_MAKL	Convert country list from \FAPSIM\INPUT\CTR_LIST.CFL into executable form.
FAPREXL	Run FAPSIM.EXE. FAPSIM.EXE must be current.
CLEANUP	Process run results: rename files, create TS files, compress results, and place in \FAPSIM\OUTPUT*ShortRunNumber*\. Parameter: short run number.
TOH	Unzip run results to the LAN H: drive. Parameter: short run number.

NEWPRTL	Run FSL CYTRD and LOADPRTL.
LOADPRTL	Create REPRT.EXE, then run REPRTL. If CYTRD.F has not been compiled since any changes were made to the program, you should run **NEWPRTL** instead.
REPRTL	Get new printed output from a CM*ShortRunNumber*.DAT binary file or files. If REPRT.EXE is not current, you should run **LOADPRTL** instead.

Country Models

\COUNTRY\	Country spreadsheet models, ready to be converted.
\CTRZIP\	Zipped versions of country spreadsheet models.

\SCFORT**CY**\	Extracted and converted country model files. The files in the remainder of this section reside in the **\SCFORT\CY** directory. The file name examples below use the Baseline version of the China model, 1997/98 interval, scenario A, which is referred to as **CHN8A**.
...\CHN8A**.ZIP**	The CHN8A country model extracted and converted files are contained within a .ZIP file to save disk space and to make file management easier.
...\CHN8A**C.SCF**	Model file name, base year column number, full country name, file dates.
...\CHN8A**E.SCF**	Model equations (cells), sorted by row number. Obtained indirectly from Excel model, through \SCFORT\EXCEL\XLFORT.XLS and \SCFORT\SCFORT.F90; or directly from Lotus or SuperCalc model through \SCFORT\CAL\SCFORT.CAL.

...\CHN8AEOL.SCF Model equations; backup before hand-editing CHN8AE.SCF. This type of "OLD" file is unusual.
...\CHN8AE.SCX Model equations, directly from Excel models, not sorted by row.

...\CHN8AL.SCF Extraction times for Excel models, for information only.
...\CHN8AN.SCF Model range names and addresses.
...\CHN8AR.SCF Range names for linked system variables, and associated commodity codes, variable codes or numbers, and link switches (<0 or ≥0); extracted from \SCFORT\EXCEL\XLFORT.XLS or \SCFORT\CAL\SCFORT.CAL.

...\CHN8AV.SCF Values of model equations (cells), sorted by row number.
...\CHN8AV.SCX Values of model equations, directly from Excel model; not sorted by row.

...\CHN8A.FOR Model Fortran subroutine. Extra numbered files may be present for a large model.
...\CHN8A.LOG Model conversion log including compiler log.
...\CHN8A.OBJ Compiled Fortran subroutine corresponding to model; backup copy stored in .ZIP file. Extra numbered files may be present for a large model.

...\CHN8AX.FOR Fortran subroutine from valued (exogenous) spreadsheet model.
...\CHN8AX.LOG Conversion diagnostics for valued (exogenous) spreadsheet model.
...\CHN8AX.OBJ Compiled Fortran subroutine from valued (exogenous) spreadsheet model.

...\CHN8A.CMP Comparison of results from endogenous and exogenous versions of model.
...\CHN8A.CBG Data used by \BAT\DUMPREA9 to locate equations in CHN8A.CIR.
...\CHN8A.CIR Unformatted direct-access listing of equations in simultaneous blocks of model, used by \BAT\DUMPREA9 for documentation.

Extraction and Conversion

\SCFORT\ Main conversion directory, which contains the conversion program (SCFORT.F90), diagnostics program (COMPSUB.F), convergence analysis program (DUMPREAD.F90), equation parsing program (PARSE.F90), equation algebraic simplification program (SIMPLI.F90), etc. Files in the rest of this section are kept in the **\SCFORT** directory.

...\EXCEL\XLFORT.XLS Program extracts Microsoft Excel model equations, values, range names, etc., and places them in \SCFORT\CY\.
...\CAL\SCFORT.CAL Extraction program for Lotus or SuperCalc models.

...\DUMPVAR.BIN Unformatted direct access file written by **COMPSUB**.BAT and read by **DUMPREA9**.BAT (see page 28). DUMPVAR.BIN may be huge, so you may need to erase it after use. DUMPVAR.BIN contains the levels of circular variables by commodity shocked, by shock size, and by iteration.

Linking and Data Aggregation Programs, and Fapsim

\FAPSIM\	This directory and its subdirectories contain Fapsim, the linking programs (in CYTRD.F), input and output data, and various utilities. The FORTRAN files have extensions **.FOR**, **.F90**, or **.F**. Directories and files in the rest of this section are kept in the **\FAPSIM** directory.
...\INPUT\	Many of the Fapsim and linker input files are kept in this directory. The linker's database-formatted control files are described in the section beginning on page 16.
...\OUTPUT\	This directory holds run results, where they may examined and compressed before being placed on the LAN.
...\OUTPUT\CYTABLES.DAT	Run diagnostics, indicators, and Rest-of-World information.
...\REPRT\	Directory for running the linker output step without redoing whole runs.
...\UTIL\	Miscellaneous utilities, including the WRAP program for checking for long equations extracted from SuperCalc.

Data Aggregation. Files listed in this section are located within a **\FAPSIM\ROWTREND** directory. However, because of their large size, TSC\, TSHISTDA.DAT, and TRENTDTY.DAT may not be on the same disk drive as the rest of these files.

...**TSC**\	Directory holds .TXT files extracted from .TSC files. The .TSC files are compressed .TS files, which contain raw FAS PS&D data.
...**RAWTDTY.DAT**	Raw PS&D data extracted from .TXT files.
...**TSHISTDA.DAT**	PS&D data aggregated by region/country, commodity, and variable. TSHISTDA.DAT is used by the linker to overwrite country/region history during the output step. Raw data come from **RAWTDTY.DAT**.
...**TSOUT**\	Directory holds TS files based on aggregated data in **TSHISTDA.DAT**. The TS files in TSOUT\ are the source of historical data for the foreign country models when the 48-commodity list is used in DATA_AGG.CFL.
...**TRENTDTY.DAT**	Trend and raw PS&D data. Trends are estimated automatically. Raw data from **RAWTDTY.DAT**.
...**ROWAGG.OUT**	Aggregated regional/country trends for the linker's Rest-of-World. Individual trends are obtained from **TRENTDTY.DAT**.
...**ROWAGFIX.PRN**	Hand-adjustments to levels or slopes in **ROWAGG.DAT**.

Other Directories

\ACCESS\	Database-importable CLS output. See the section on CLS output, page 9.
\CSORT\	Sorting program used by \SCFORT\DUMPREAD.F90.
\TS\TSC\	Compressed TS files that may be used by the data aggregation programs.

Operating the Linker

Examples below generally assume use of the China model, 1997/**98** Baseline interval, scenario A, whose code or abbreviation is CHN8A. Commands that should be typed as shown are in **BOLD** capital letters. For an overview of the linker's processes, see Figure 3 (page 52).

Setup

SET Commands. Because the drive letter in which a directory is located may vary by computer, only LAN drive letters are spelled out in this report. The \SCFORT\ and \FAPSIM\ directories should be on the same drive. Computer- and directory-specific drive letters are made available to linker programs through environment variables, specified in an AUTOEXEC.BAT file under DOS, Windows 3.1, Windows 95, and OS/2. Each "?" should be replaced by a drive letter:

```
SET  COUNTRY=?:\COUNTRY
SET  CSORT=?:\CSORT
SET  CTRZIP=?:\CTRZIP
SET  DIRF77L3=?:\F77L3          (Fortran 77 compiler)
SET  DIRLF90=?:\LF9035          (Fortran 90 compiler)
SET  FAPROWTS=?:\FAPSIM         (for \FAPSIM\ROWTREND\TSC\, TSHISTDA.DAT, and
                                \TRENTDTY.DAT; see Data Aggregation on page 30)
SET  FAPSIM=?:\FAPSIM
SET  SCFORT=?:\SCFORT
SET  TSDRV=?:\TS                (TS files).
```

Under Microsoft Windows NT, these variables are best specified under Settings, Control panel, System, Environment, User variables.

PATH. The directory \BAT\, which contains the .BAT files that start linker programs, should be specified in the PATH.

Extraction

Some of the following steps may apply only to models housed in Lotus or SuperCalc, or in Excel. If no software is designated, the step applies to all models.

Receive Models. Save files to the \COUNTRY\ directory, usually from e-mail. Write file names and extensions in notebook. Files typically trickle in over a period of weeks, and files typically are modified repeatedly as linking and economics problems are fixed.

Convert Lotus to SuperCalc. If any files have extension .WK*, load into Lotus 5. If processing the Taiwan (TWN) or Hong Kong (HKG) models, do /**R**ange**N**ame**R**eset and then /**R**ange**N**ame**L**abel**R**ight on column with labels (on the right, about column AH). Save file with .WK1 extension. Load (/**L**oad) into SuperCalc and save (/**S**ave) with .CAL extension.

Base Year Column; SuperCalc and Lotus. In beginning of Baseline or with new model, get correct column number of base year, by loading first few rows of model into SuperCalc and entering **TCOL** function in base year column. If it is unclear whether headings are for calendar year or crop year, get a couple of unique-looking levels from a few years prior to the base year and then use TS data to determine the year. (Encourage analysts to use crop year "97/98" type of heading to make matters clear.)

Note File Dates. Go to a DOS window. Enter **FCZ** (.BAT file to display the \CTRZIP and \COUNTRY subdirectories in QFiler). In notebook, write down dates and times of original files and any new .CAL files.

Load Extraction Program: SuperCalc. Run SuperCalc and type **/XS** to execute S.XQT, which loads extraction program \SCFORT\CAL\SCFORT.CAL. If helpful, turn on titles for the country/variable definition table with **Alt-D**.

Load Extraction Program: Excel. Run Excel and load \SCFORT\EXCEL\XLFORT.XLS. Press **Home**.

Update Model Parameters. Set all EXTRACT switches to -1. Go to column for a country model to be extracted. The first three characters of the country RUNNAM must be the standard country code, because the characters are matched with settings in other linker control files. The fourth character should be the Baseline year number. The fifth and last character may be a project-specific letter or number. Examine and probably change country file name (FULLNAM) and date and time of original (Orig dat) and any revised version (Used dat). The date/time format maximizes the information that can be seen without moving the cursor over the cell. The file date and time are essential for documentation.

Extract; SuperCalc. Set EXTRACT switch for given country to **1**. Update the base or initialization year column number if necessary (usually just once a year, in August). Use **/S**ave command to back up SCFORT.CAL. Run extraction macro with **Alt-R**. Type **E** to extract full model or type **L** to extract only variable names and country-specific variable linking switches. This extraction step runs fastest under stand-alone DOS enabled by Windows 95 software.

If the file name was entered incorrectly, the macro will stop on the second page, used for the temporary country file. Use **F5** to go to the range name FILENAM and see the name of the file that wasn't found. Fix the file name. Set EXTRACT switches to **-1** for any files already extracted. Begin extraction again with **Alt-R**.

The macro will cause a beep when extraction ends. Again, use the **/S**ave command to save SCFORT.CAL. Some of the concepts used by the extraction program, SCFORT.CAL, are the same as concepts used by the older spreadsheet-based linker (Seeley, 1994).

Extract; Excel. Set EXTRACT switch for given country to **199**. Press **Ctrl-E** to extract full model or **Ctrl-L** to extract only variable names and country-specific variable linking switches. The macro will cause a beep when extraction ends. Save XLFORT.XLS.

Compress Models. Go to a DOS window and enter **FCZ**. On the \CTRZIP\ side of the QFiler screen, go into the directory for a country whose model was extracted as above. View the subdirectory or subdirectories for the most recent version. Check file name, date, and time on zipped file or files. If the extracted model was already zipped, delete the spreadsheet in \COUNTRY\.

If the model was not yet zipped, create a new directory such as \CTRZIP\CHN\98_BLN7.ORG. The baseline date designation 98 would be used until the 98/**99** baseline models become available, possibly in August 1998. The sequence number would increment from 1...9 to A...Z, allowing the directory names to be sorted in the correct order. The directory extension .ORG means original, .INT means intermediate (not used often), and .USE means edited or converted if necessary (for example, from Lotus 1-2-3 to SuperCalc). Move the file from \COUNTRY\ to

the new directory. Place the cursor on the file name. Press **Ctrl-E** and type **CZ** and press **F10** and press **Enter** twice, to zip and protect the file while retaining the same file name and date. The program **CY** does the same thing, but without protecting the .ZIP file.

Conversion

Create SCFORT.EXE. Close any windows that aren't needed, if RAM is a constraint. Go to a DOS window. If \SCFORT\SCFORT.OBJ is not present or is older than \SCFORT\SCFORT.F90, recreate it by entering **NEWSCF9**. Otherwise, if SCFORT.OBJ is current but \SCFORT\SCFORT.EXE is not present, recreate SCFORT.EXE by entering **LOADSCF9**.

Access H: Drive. If possible, ensure that the computer is connected to the LAN H: drive so that SCFORT9.BAT can copy diagnostics to the H:\DIAGNOST directory, for use by other analysts.

PROJYR.CFL. Edit PROJYR.CFL and set the final projection year, IYREND.

SCFORT.CFL. Edit or view the SCFORT.CFL file. You might want to turn the country run diagnostic switch (ICNVSW) on or off, depending on whether or not any circular block in a model had difficulty converging. Make sure that any base year column offset (IBASOF) is turned off (=0) unless appropriate. The base year column offsets had to be set at **1** in August and September 1996 for 1995/96 baseline models that were being run together with revised 1996/97 models, which had a later base year. Set IVDUMP=0 unless you are trying to diagnose slow convergence in a circular block of that model.

Convert one model. To convert the example China model, type **SCFORT9 CHN8A**.

Convert several models. To convert several models, edit \BAT\SCF9.BAT. (SCF9 does not work consistently under Windows NT DOS at the time of this writing.) Ensure that the **REM** command is on the left for any models not to be converted. Clear the REM command for any models to be converted. Save SCF9.BAT. Go to a DOS window and enter **SCF9**.

Conversion Results

Examine results. When conversion is done, enter **FSC** (.BAT) to use QFiler to examine conversion results, as discussed below.

Number of files. Ideally, only two files will be visible for a typical country model; one is an .OBJ file, with a time and date that correspond to the new conversion, and the second is a .ZIP file (although large models such as Bangladesh or China may result in more than one .OBJ file). Examine the contents of the .ZIP file. (In QFiler, move the cursor over the .ZIP file name and press **Enter**.)

.CMP File Size. Look at the .CMP file size. If the size is 351 bytes or characters (given the current file format), then the converted model equations and the valued spreadsheet give the same results for linked variables, down to 0.00005. If the size of the .CMP file is less than 351 bytes, the comparison did not complete running, perhaps because the CHN8AX.OBJ file wasn't created. In this case, it is unlikely that the CHN8A.OBJ file was created or updated. Check the .LOG and .CPL files.

.CMP File Problems. Otherwise, look inside the .CMP file to see if the largest difference is acceptable. Differences can be caused by the @ROUND or similar step functions (e.g., the Taiwan model). Also, models with circular blocks that the analyst did not recalculate thoroughly may show up because the linker probably uses a much tighter tolerance. Any difference greater that 10.0 should be tracked down.

The last such problem encountered arose because there was an old named range in the same row as a current named range. The model was converted using the old variable name, which was encountered first, but the old variable was never initialized. A corresponding error message from REPLAC in the .LOG file indicated that the current variable name could not be used (the old variable name had already taken its place). The solution was to remove the old variable name from the model, or to edit CHN8AR.SCF (after backing it up to an "OLD" name such as CHN8AROL.SCF) and make the row number for the old variable negative. A request was made to the analyst that the old range name be removed from the model.

.LOG file. Look in the CHN8A.LOG file. Note any message about a base year column offset; was an offset intended? Note any other error message. If there is any message from ORDYR about leads, look in H:\DIAGNOST\LEADS\CHN8A.LED (or \SCFORT\LEADS\CHN8A.LED if H: is not accessed). Notify the modeler, who may be able to use the diagnostic info to repair the model without further assistance. There also is optional advice in the H:\DIAGNOST\LEADS\-LEADS.DOC file on how to check for leads using the spreadsheet auditor in SuperCalc, if necessary.

"Invalid operator". Any message such as "Invalid operator" may be caused by a subscripted variable name that terminates with the "NOT(" string; for example, "DMGNOT(" which actually refers to Other demand for Groundnuts; in this case, the "Invalid operator" message may be ignored. (No genuine problems have been signaled by this message, so the message may be deleted.)

Compilation. Note any Fortran compilation error messages. "Never used variable" messages for ISERR and ISNA may be ignored. If the conversion stopped after compilation, the compiler messages will be in \SCFORT\CY\CHN8A.CPL.

Long Equations. If the CHN8A.LOG file is still out in the \SCFORT\CY directory, look at its contents. If CHN8A.LOG ends with a statement that variable names for equation and value do not match, then there was probably at least one equation that was too long to export correctly from SuperCalc. Long equations usually arise in CPPA models with elasticity matrix calculations (as of April 1998). Get a rough idea of the locations of similar problems by running **WRAPL CHN8A** and viewing \SCFORT\CY\WRAPOUT.DAT. Write down the row numbers of apparent problems. Look in the CHN8AE.SCF file at the problem row numbers to get more precise locations for the problems. Inform the modeler about long equations, giving country name and row numbers. Otherwise, if the long equations can be valued without loss of endogeneity, back up the CHN8AE.SCF file and replace equations in the rows with damage, using values from CHN8AV.SCF.

Equation Space Too Small. If CHN8A.LOG indicates "READIN NEQVBG(IEQN+1) > MXEQVC" then first find how much to raise MXEQVC, to allow SCFORT.EXE to hold more equations (MXEQVC is the sum of space reserved for all stored equations). This problem is most likely to occur with the China model because of its size. Note the address of the cell that would have filled EQNVEC to overflowing, and find that cell in CHN6E.SCF. Adding a space after the address may limit the search to finding the cell address on the left-hand side of its equation.

Note the relative position of the variable in the file, and estimate how much of an increase in capacity will be needed for MXEQVC. Next, erase \SCFORT\PARAMETR.INC. Edit \SCFORT\SCFORT.F90. Go to the bottom of the file and find the PARAMETER block. Increase MXEQVC from the current 16000000 (as of April 1997). The number of characters added to the vector equals the number of bytes added to SCFORT.EXE, so do not add much more capacity than needed. Copy the PARAMETER block to a file named \SCFORT\PARAMETR.INC. Save SCFORT.F90. Run **NEWSCF9** to recreate SCFORT.EXE.

Too Many Equations. It is also possible that MXEQN, the total number of equations stored, would need to be raised. There would be a message such as "READIN: EQUATIONS >= ######." Fix with the same kind of procedure used above for MXEQVC.

Note results. If conversion was successful (the .CMP and .LOG files appear to be correct), check the model off in the notebook. Otherwise, note approximate problem, then notify the analyst. If there is a lot of detailed information, use e-mail or a written note.

DIAGTOH. If computer was not logged on to the LAN during conversion, run **DIAGTOH** when the computer is next connected to the LAN.

FAS PS&D Data

.TSC File Dates. Compare the dates of the LAN M:\TA\TS\TSC*.TSC and local \TS\TSC*.TSC files (in QFiler, display the directories and press **Alt-T** and then **N**). These data are placed in the LAN M:\TA\TS\TSC directory by Linda Beeler, approximately between the 18th and the 20th of each month.

Update DATA_AGG.CFL. Confirm that \FAPSIM\ROWTREND\DATA_AGG.CFL is current in its listing of countries, commodities, variables, coverage, and aggregations.

Free Disk Space. Ensure that disk space is free for \TS\TSC\ and \FAPSIM\ROWTREND\TSC\, or intermediate data files will be truncated. This problem can be difficult to spot. 100 MegaBytes free may be enough.

Process New or Current .TSC files. Enter **9TSALL GETTXT** to process new TS files from the LAN M: drive; otherwise, enter **9TSALL NOTXT** to process the current TS files. When the programs are done (perhaps 10-15 minutes), check results in the \FAPSIM\ROWTREND*.OUT files.

Processing Problems. If the column or variable headings have changed and no longer match, run **9COLHED** to get a listing of the column headings in the \FAPSIM\ROWTREND\TSC*.TXT files. These new headings can be used to update the NVRN14 headings in \FAPSIM\ROWTREND\DATA_AGG.CFL with the help of block moves. If the country names did not match in RAWTS.OUT, add to or modify the NTNRGN data in DATA_AGG.CFL.

Setting Other Data

1. \FAPSIM\INPUT\ROWPARM.CFL holds parameters for the Rest-of-World.
2. \FAPSIM\INPUT\TOTPRD.CFL holds optional world production and export totals.
3. \FAPSIM\INPUT\PRICES.CFL holds reference prices, ratios, and deflators.
4. \FAPSIM\INPUT\ARMINGTN.CFL holds Armington input data and parameters.

Linking

The extraction, conversion, and data steps described above should be completed before linking.

Specify Countries. Edit \FAPSIM\INPUT\CTR_LIST.CFL and set the number of country model versions, IVERSB. In NCTRSB, list the country model versions for the base or reference run. If two versions will be used for any country, also list the second version.

Specify Years, Switches, Documentation. Edit \FAPSIM\INPUT\PROJYR.CFL. Ensure correct values for settings, especially IYREND, IFCSSW, IYROFS, IARMSW, and RUNDOC.

Specify shock files. Edit \FAPSIM\INPUT\FAPFILE. Ensure reference to the appropriate \FAPSIM\INPUT\CYS____.CFL foreign shock file, perhaps \FAPSIM\INPUT\CYSETNUL.CFL. Check with Mike Price about the appropriate \FAPSIM\INPUT\KW____.DAT U.S. shock file.

Specify Output Settings. Edit \FAPSIM\INPUT\OUTPUT.CFL. Ensure that the appropriate block (MAS, FUL, or PUB, etc.) is uncommented. To uncomment FUL, also uncomment the first half of the MAS block, as noted in the file.

Disk Space and RAM. If disk space is limited, erase \FAPSIM\REPRT\REPRT.EXE, \SCFORT\SCFORT.EXE, \SCFORT\COMPSUBR.EXE, \SCFORT\DUMPVAR.BIN, and possibly other files. Ensure that country models are zipped if \COUNTRY\ is on the same drive as \FAPSIM\. The .MAS output uses about 180 MB of disk space in \FAPSIM\OUTPUT, and the .FUL output about 220 MB for either commodity TS *or* country TS output (as of this time). If RAM is limited, close other windows.

Begin Run. If CYTRD.F has been edited, run **NEWCYL**. Otherwise, if country models have been newly converted or re-compiled, run **LOADREXL**. Otherwise, run **FAPREXL**. When linking is progressing (rows of integers slowly appear on the screen), you can open other windows again, within reason.

Check Completion. When the run has completed, read any error message on screen. If there is no error message, press **Enter**. Look at the scenario world imbalance in \FAPSIM\OUTPUT\SP.IMB to confirm that the run converged; expect numbers no larger than 0.4 for the projected years, and the initialization year as well if PS&D data did not overwrite that year. Look in SP.PRI to confirm that the run completed all years. Look in CYTABLES.DAT and FAPSIM2.DAT to confirm that the system ran without errors. Look in SP.AVG to get a quick overview of the results.

Process Results. If the run looks OK, get the short run number by looking in an output file. Run **CLEANUP**.BAT with the short run number as a parameter, in order to rename files, create TS files, and compress results. When CLEANUP is completed, the computer will beep.

Results to LAN. If the run results are to be put on the LAN H: drive, run **TOH** with the short run number. When TOH is done, go to the H: drive and rename the directory with the appropriate suffix (.PSD, .NPS, .PSF, etc.). Move the new run directory from H:\TEMP to the appropriate directory. Don't delay the rename and move steps, because you may not be able to perform them if the directory is in use by other analysts.

Linking Problems

Disk Space. If the run didn't complete, it may be because of insufficient disk space. If the body of the run completed and the problem occurred after successful saving of the \FAPSIM\OUTPUT\CYCOMMON.DAT file, it is possible to clear disk space, in particular by removing \FAPSIM\FAPSIM.EXE. Rename CYCOMMON.DAT to CM*ShortRunNumber*.DAT and then rerun the output step. However, if the run stopped because of inadequate disk space, the CYCOMMON.DAT file may not be usable.

Foreign Convergence Problem. If the run stopped with an ITRFOR message, look in FAPSIM2.DAT. Search for "ITRFOR." If NCDN3 is not "SB," "SO," or "SM" (soybeans or products), the problem will be easier. Use **Alt-E** to give small type. Repeatedly search for the first country name, forward (**F3**) or backward (**F9**). Note which country and variable is changing most. Common sense may help; if a given country's feed, total consumption, and imports are changing by about the same amount across variables, then the problem probably originates in feed as the other two variables may simply be identities that depend on feed. Next, repeatedly search for country names until the changes for all countries can be compared. Because of simultaneity, multiple changes may be seen, but usually one will stand out because it is abrupt and large. Look in the model or \SCFORT\CY\CHN8AE.SCF file for **IF(** expressions, which are almost always the source of discontinuities. Usually it is not worth focusing on **IF(ISERR(** expressions; variables with ERROR values during conversion are not explicitly linked. It also may help to check cells that refer to themselves, listed in H:\DIAGNOST\SELFREF\CHN8A.SLF.

Controlling Country Convergence. If you can narrow the problem down to one model and variable, usually the quickest way to handle the problem is to edit \SCFORT\CY\CHN8AE.SCF, after backing it up to an "OLD" name such as CHN8AEOL.SCF. Use text-editing software that can handle large files, such as PFE, MEGAEDIT, or ED. The easiest general fix is to edit the equation for a cell that refers to itself, for example V1 (self-referencing cells may be seen in H:\DIAGNOST\SELFREF\CHN8A.SLF). The problematic line would look something like

V1 = IF(V2>V3,V1*(1-V4/V5)*.7,V6)

After the fix, it would look something like

V1 = **.6*V1+.4***IF(V2>V3,V1*(1-V4/V5)*.7,V6)

Parentheses were not needed after the **.4*** in this case, because the **IF()** is self-contained. The weights **.6** and **.4** (=1-.6) might not be optimal, but the important thing is to slow adjustment of V1. Weights of .5 and .5 (=1-.5) might be a good starting point. It is not a good idea to slow adjustment of identities, only cells that adjust themselves and cells with discontinuities. V1 has both, because the ELSE value, V6, is not likely to equal the THEN expression. Reconvert CHN8A and rerun the system. Where possible, analysts should be encouraged to replace IF() expressions with MAX() or MIN() expressions.

Soy Complex. For soybeans, soyoil, and soymeal (the soy complex), it will be necessary to find which of the three commodities has the problem. (So far, problems have not arisen in more than one commodity per run.) Look for the largest change across commodities, keeping in mind that soyoil levels and changes might be expected to be smaller than those for soybeans.

Variable Changes Exceed Tolerance. It is possible to examine, for each iteration, the levels of variables in a country model's simultaneous (circular) block, whose changes exceed the convergence tolerance. Set ICNVSW=1, re-convert the problematic model, and run the scenario again. This approach is time-consuming.

Debug Line-by-Line. It may be useful to run the system line-by-line and display the of levels of variables as needed. This DOS-based approach does not always work under Windows NT DOS.

1. Change directory to \SCFORT\CY\.
2. **PKUNZIP** CHN8A CHN8A.FOR
3. **FSCL** CHN8A **/S**
4. Move CHN8A.FOR, CHN8A.OBJ, and CHN8A.SLD to \FAPSIM\.
5. **LOADFAPL**.
6. Change directory to \FAPSIM\INPUT\
7. **SOLD3 \FAPSIM\FAPSIM**

Dump Circular Variables? In the future, the linker may be enhanced so that it will automatically turn on the variable-by-iteration dump when a run is about to stop because of convergence problems.

Introducing Scenario Shocks

Exogenous Region. Shocks to the exogenous region may be applied in \FAPSIM\INPUT\EXOG_RGN.CFL. Exogenous production or consumption (and thus exports or imports) may be specified by commodity and year.

Exogenous Prices. Optional exogenous world prices may be set in \FAPSIM\INPUT\PRICES.CFL by introducing price ratios for the CYPXOG variable. If any world price is set exogenously, then all world prices are exogenous. The default CYPXOG ratios are 1.0, which means no change from Baseline prices. Therefore, to run with all exogenous Baseline prices, simply introduce a CYPXOG ratio of 1.0 for one commodity in one year.

Shocks to Variables. During model conversion, \SCFORT\DEFSHOCK.CFL defines shocks by variable, year, and type. During a linked run, a \FAPSIM\INPUT\CYS_____.CFL file may set shock levels for any of the variables and shock types defined in DEFSHOCK.CFL when the model was converted. A CYS_____.CFL file must be specified in \FAPSIM\INPUT\FAPFILE. The CYS_____.CFL files contain documentation about the way in which shocks are specified.

If the variable to be shocked is not yet linked, then its range name, commodity name, and variable number or name should be defined in \SCFORT\EXCEL\XLFORT.XLS or \SCFORT\CAL\SCFORT.CAL. New shock variables usually are associated with exogenous shock commodities X1 or X2. Revised variable definitions may be extracted using the Excel **Ctrl-L** macro or the SuperCalc **Alt-R** macro with the **L** parameter. Next, the country model must be converted. In \FAPSIM\INPUT\OUTPUT.CFL, specify NVRHED column headings, NCLVR variable order, and NORDCD commodity order.

Armington Shocks. \FAPSIM\INPUT\ARMINGTN.CFL defines Armington shocks. The file contains documentation.

U.S. Shocks. Check with Mike Price about the appropriate U.S. shock file (\FAPSIM\INPUT\KW____.DAT). The appropriate U.S. shock file must be specified in \FAPSIM\INPUT\FAPFILE.

One Run. The most convenient run is one in which the reference portion of the run has the appropriate assumptions, and in which the scenario portion of the run has assumptions that differ from the reference assumptions exactly to the extent of the scenario. Then, the levels of

the reference and scenario portions of the same run can be used as is. The absolute levels in the same run might be usable in the case of a scenario performed in post-Baseline mode (IFCSSW=0) with calibrated models. If models are not calibrated, but absolute levels are less important than differences between scenario and reference, and absolute triggers (such as the world price at which the European Union can export without subsidy) are not a concern, then post-Baseline mode and just one run might again be adequate.

Two Runs. If models are not yet calibrated, but it would be desirable to have model levels closer to Baseline levels, then two runs in baseline mode (IFCSSW=1) may be used. The first run would receive no external shocks, so the scenario portion of the run could be used as an endogenous output "base." The second run would be shocked, so the scenario portion of the second run could be used as an endogenous output "scenario." The scenario portions of the two runs would be combined and compared by running the output step again, as described below.

Two Versions of a Model. Scenario shocks may be introduced by the linker. However, if the scenario changes are not well documented by the analyst, or the scenario involves changes in the form of equations, it might be desirable to use different versions of the model for the reference and scenario portions of the run. To use two different versions of a model, edit \FAPSIM\INPUT\CTR_LIST.CFL, set IVERSB=2, and specify the two versions in NCTRSB (see page 23). It is important that the two versions of a model differ only to the extent of the scenario shocks. If the versions differ in the initialization year, diagnostic messages will appear in \FAPSIM\OUTPUT\CYTABLES.DAT. To ease file management and limit the number of conversions, it usually is preferable to have the linker introduce the scenario shocks, and to use only one version of each model.

Running the Output Step Again

The linker's output step is invoked at the end of each linked run. The user can also rerun the output step without relinking, in order to use different output parameters in \FAPSIM\INPUT\OUTPUT.CFL, to combine results from more than one run (see page 3), or to get output from a run that ran out of disk space. The data files should have names like \FAPSIM\OUTPUT\CM*ShortRunNumber*.DAT. To reprint, edit \FAPSIM\INPUT\PRTFILE to specify the correct short run numbers, and then run **REPRTL** (or **LOADPRTL** or **NEWPRTL**; see page 28 for descriptions of these different programs).

Incorporating a New Version of Fapsim

Source Data and Programs. The source computer in this discussion is used by Mike Price. Get permission before proceeding. Zip \FAPSIM\INPUT*.* and \FAPSIM*.F* (without removing the regular versions of those files), and copy the .ZIP files to the LAN M: drive. Include any needed utility Fortran files from other subdirectories, as indicated by Mike Price.

Destination Data. The destination computer in this discussion is used by Ralph Seeley. Again, get permission before proceeding. Copy destination data files from \FAPSIM\INPUT\ to another directory, and Zip the copies. Unzip the source data files into a temporary directory. Consider any source files with the same names as destination files. Use the destination version of PRTFILE. Compare and merge FAPFILE files. Otherwise, usually use the source files.

Destination Programs. Copy destination Fortran files from \FAPSIM\ to another directory, and Zip the copies. Unzip the source Fortran files into a temporary directory. Compare source and

destination files. Use destination CYTRD.F, FILDEF.F, and GETSET.F files. Have a look at SOLVE, MAIN, ECOT, ECRN, ERICE, ESOR, ESOY, EWHT, EBEEF, EPORK, and ECHIC. You may need to merge separate advances in the two versions of these files. Offer the merged files to Mike Price. Rename the old compile log. Compile all (**COMPALL** *). Check results. Ensure that FAPFILE is updated. Run linker with no foreign country models, with IFCSSW=0, with CYSETNUL.CFL specified in FAPFILE, and with no data in the exogenous region; there should be no price changes.

Changing to a New Baseline

Base Year Column. For non-Excel models, check and update base or initialization year column numbers in *\SCFORT\CAL\SCFORT.CAL*. Update the Baseline year digit in the country file code; for example the "8" in CHN8A, for the 97/**98** Baseline. If the base or initialization year is being adjusted and the system is needed in the meantime, use a column offset in \SCFORT\SCFORT.CFL when re-compiling old models.

Array Years. It may be necessary to change MNYR, MXYR, and MNYRTS in the parameter block of \FAPSIM\CYTRD.F. Copy the parameter block into a new \FAPSIM\PARAMETR.INC file. Run FSSL COMPSUBR to recompile \SCFORT\COMPSUBR.F with the new \FAPSIM\PARAMETR.INC.

Run Settings. Ensure no shocks by referring to CYSETNUL.CFL in \FAPSIM\INPUT\FAPFILE. In \FAPSIM\INPUT\PROJYR.CFL, set IYRBAS, IYREND, and RUNDOC. Set IFCSSW=1 and normally set IYROFS=0.

PS&D Aggregation. In \FAPSIM\ROWTREND\DATA_AGG.CFL, update coverage in the NTNRGN, NCNN25, and NOTHRG tables. Perhaps run 9TSALL to incorporate new FAS PS&D data. Possibly edit \FAPSIM\ROWTREND\ROWAGFIX.PRN to specify fixes for the trend slopes provided automatically by ROWAGG.OUT.

Optional World Totals. In \FAPSIM\INPUT\TOTPRD.CFL, update the main commodity trade totals obtained through Paul Westcott. Update projections of world data for Other coarse grains, Other oilseeds, Other oils, and Other meals with data from ROWAGG.OUT. Repeat if country coverage changes.

Prices Update prices in \FAPSIM\INPUT\PRICES.CFL, using the TS or spreadsheet price file from Rip Landes. In August 1997, the files were in the H:\98INOUT\98PRICES\AUGUST\ directory and were named PRICE98.TS and 97BL.CAL. Update the GDP deflator using the macro spreadsheet from David Torgerson, obtained through Paul Westcott.

Output Settings. In \FAPSIM\INPUT\OUTPUT.CFL, use the MAS block settings in general. Set years printed (NDPVTY) to allow one full page per block (usually 63 lines with the Line Printer font). Select display of the base, scenario, and percent differences (NORDLG).

Setting Up for Baseline Publication

1. *\FAPSIM\INPUT\FAPFILE:* Ensure no shocks by using shock file CYSETNUL.CFL.
2. *\FAPSIM\INPUT\PRICES.CFL:* Set some price ratio, CYPXOG, = 1.0.
3. *\FAPSIM\INPUT\OUTPUT.CFL:* Use the Baseline publication block settings for commodity order and variables. Only generate output for the scenario.
4. *\FAPSIM\INPUT\PROJYR.CFL:* Set IFCSSW = 0. Set comment (RUNDOC).

Applied Armington Subsystem

A form of Armington procedure in the linker allows introduction of bilateral tariff concessions, giving endogenous effective tariffs, bilateral trade flows, and bilateral prices by country, commodity, and year.

Introduction

The linker used in this analysis combines foreign country models with a large econometric model of the United States (Fapsim), the rest-of-world (ROW), and a residual region to make a linked system which arrives at a simultaneous equilibrium in prices and quantities for 24 commodity markets. Equilibrium is reached when commodity prices are found that cause world imports to approximately equal exports, within a reasonable tolerance. The resulting world solutions are carried out over several projection years.

Variables and constants such as country income and tariffs are reset at appropriate points by the linker. The variables to be shocked, the types of shocks, and the sizes of the shocks initially are specified in data files (\FAPSIM\INPUT\CYS_____.CFL and \FAPSIM\INPUT\ARMINGTN.CFL). The percentage bilateral import tariff changes facing exporters are fed in from ARMINGTN.CFL. However, the combined tariff affecting an importer's consumers depends in part on the relative size of different bilateral trade flows from the Armington process, so the effective import tariff shocks are endogenous. In the Western Hemisphere liberalization scenarios, about 5,000 shocks were introduced to incomes and to bilateral tariffs (see page 2).

Initialization

It is useful to be able to examine differences between scenario and reference run results. The differences are revealing when changes exclusively result from scenario shocks. Therefore, an attempt is made during initialization to ensure that the scenario run results would be the same as reference run results in the absence of a shock. In the scenario run, the introduction of calculated Armington trade flows and reference prices must not be perceived as a shock to the system, so the Armington prices and trade flows are also computed in the reference run.

Armington Procedure--Summary

We can summarize the applied Armington process used in this analysis to give bilateral trade aspects to a system of total trade models:

1. Provide the country models with a trial set of prices.
2. Country models respond with supply and demand.
3. Given the base demand matrix for a given good, bilateral price differences caused by bilateral tariff rate changes, and an elasticity of substitution, determine country-specific export prices such that the scenario demand matrix has row and column sums equal to country model demand and production.
4. Revise the quantity-weighted prices and tariffs to be inserted into each country model, and loop back to step 2.

The demand matrices are trade matrices, but with demand for own production on the diagonal. Row sums equal total country demand, while column sums equal total country production.

Armington Procedure--Details

Following is a more complete description of the heart of the linker's applied Armington process for a given commodity. The discussion assumes a scenario involving a regional trading group in which member importers offer bilateral tariff concessions to member exporters.
At the beginning of a run:

1. Start with a historical average trade matrix and with country model results from the initial year of a run.
2. For each country, define the demand for its own production as being equal to country model demand minus trade matrix imports, with the result prevented from being negative.
3. Add a small constant to each element of the matrix, to permit new trade flows and to make the solution more stable. This optional addition helps in stabilizing the valuation of demand for each country's own production.
4. Set Armington β values (see the equations below) to satisfy the conditions $\Sigma \beta = 1$ and $\beta \geq 0$, while giving reasonable results in generating trade flows.

At the beginning of a call to the Armington procedure:

5. Start with country model production levels, then scale each to get Armington production targets such that world production target = world demand sum; otherwise the applied Armington procedure will not converge.

During a call to the Armington procedure, repeat the following steps:

6. Set exporter price indices (the basic indices facing nonmember countries) such that each country's production target is met.
7. Reduce the bilateral exporter price to the extent of the reduction in the tariff. For example, if the importer had a 10-percent ad valorem tariff facing nonmember countries but offered a 50-percent reduction in the tariff to member countries, the bilateral price to members would be (1 + 10/100 * 50/100) / (1 + 10/100), or about 5 percent lower than the price would have been in the absence of a preferential tariff concession.
8. Find Armington demand levels by origin and destination.
9. Scale country demand by origin so that the sum equals total demand in the country model.

After a call to the Armington procedure:

10. Scale bilateral imports by each importer to sum to country model total imports.
11. Calculate weighted average reference prices for each country, given that country's trade volumes with its trading partners and the respective bilateral prices. Average this country-specific price and the world price to ensure the stability of the solution procedure.
12. Calculate weighted average import tariffs for each country, given that country's trade volumes with its trading partners and the respective bilateral tariffs.

Resume operation of the rest of the modeling system:

13. Run each country model with the country-specific endogenous world prices and tariffs.
14. If there is any significant imbalance between world supply and demand, adjust the overall world prices and loop back to step 5.
15. If world supply and demand are approximately in balance, proceed to next projection year and then loop back to step 5.

Matching Armington and Country Model Results

The Armington equations assume Hicksian demand. This assumption is not necessarily correct for the current models. A decision was made to use the Armington approach despite the lack of Hicksian demand.

There are five variables that could be aligned between a country model and the applied Armington process. The variables are the country's reference price, consumption, production, imports, and exports. The reference price from the applied Armington process and the world price are averaged and fed to the country model as its world price. The averaging improves the stability of the solution.

Demands by origin in the Armington stage are scaled to sum to the country model's demand. The scaling is consistent with the fact that the Armington approach only provides information on demand shares by origin.

Production implied by the Armington process approximates the country model's production. If world stock levels change little from one year to the next, the match between production in the Armington stage and the country model will be closer. The above-mentioned adjustment of total imports for each country typically prevents the printed sum of Armington demands by destination from exactly equaling the country model production.

Total imports in the printed Armington matrix are scaled to equal total imports by a country model. If the country model shows no imports, then the printed Armington matrix does not either. The printed diagonal element (demand for own production) is adjusted to keep the total Armington demand equal to the country model demand.

Exports are the residual of this process. Exports may differ significantly between the Armington and country models.

The Armington process used here could have been set up to target a match between each country model's imports and exports, and the solution Armington matrix. This would have made the Armington export levels correspond with those in the country models. However, such an emphasis on relatively sparse off-diagonal elements of the Armington matrix, to the neglect of consumption of own production, would have made the solutions less stable.

Applied Armington Equations

The equations used in the Armington-type procedure are shown here. Specific or unit tariffs were also included but are not shown in these equations. A year subscript is implicit for each variable except for β, σ, and ρ.

Variables and constants:

σ = Constant elasticity of substitution

F = Fraction of an importer's full bilateral tariff T that applies to a particular exporter. If the full tariff applies, F = 1. If the exporter receives a preferential tariff reduction, F < 1.

p = Price

P = Armington price index

T = Ad valorem tariff in percent, which applies to countries not receiving a preferential tariff reduction.

x = Demand

X = Armington demand index

Subscripts:
AVG = Average
I = Good
L = Importer
J = Exporter
K = Country index for summation.

$\rho_{IL} = 1 / \sigma_{IL} - 1$

β must meet the following conditions:

$\Sigma_J \beta_{ILJ} = 1$ and

$\beta_{ILJ} \geq 0$;

therefore, at the beginning of the run set

$\beta_{ILJ} = x_{ILJ}^{1/\sigma IL} / \Sigma_J x_{ILJ}^{1/\sigma IL}$.

— Adjust the bilateral Armington price indices:

$p_{ILJ} = p_{IJ} \ (1 + T_{IL}F_{ILJ} / 100) \ / \ (1 + T_{IL} / 100)$.

Define the Armington demand index:

$\mathbf{X}_{IL} = (\Sigma_J \beta_{ILJ} x_{ILJ}^{-\rho IL})^{-1/\rho IL}$.

Define the Armington price index:

$\mathbf{P}_{IL} = (\Sigma_J x_{ILJ} p_{ILJ}) / \mathbf{X}_{IL}$.

Use the main Armington equation to determine demand flows:

$x_{ILJ} = \beta_{ILJ}^{\sigma IL} \mathbf{X}_{IL} (p_{ILJ} / \mathbf{P}_{IL})^{-\sigma IL}$.

Scale x_{ILJ} so that $\Sigma_J x_{ILJ}$ = country model demand.

Revise p_{IL} so that $\Sigma_L x_{ILJ}$ approaches country model production.

— Loop back until $\Sigma_L x_{ILJ} \approx$ country model production.

Set weighted average country prices as functions of import and export prices:

$p_{IL,AVG} = (\Sigma_J p_{IJ} x_{ILJ} + p_{IL} \Sigma_K x_{IKL}) / (\Sigma_J x_{ILJ} + \Sigma_K x_{IKL})$.

Set weighted average import tariffs:

$T_{IL,AVG} = T_{IL} (\Sigma_J F_{ILJ} x_{ILJ}) / (\Sigma_J x_{ILJ})$.

Input

1. Country models with explicit, visible tariff levels.
2. Initial trade matrices, by commodity
   - including the ROW
   - 3-year to 5-year averages for more robust solution.
3. Schedules of tariff changes by:
   - Commodity
   - Importer
   - Exporter
   - Year
   - Type of tariff: Ad valorem or specific (unit).
4. Overall elasticity of substitution and any importer- and commodity-specific elasticities of substitution.
5. GDP changes.
6. Analyst expertise.

Output

1. Endogenous trade (demand) matrices.
2. Endogenous bilateral price indices.
3. Summaries of quantities and prices.
4. Database output; make your own tables.

Problems

Matching Armington and model variables. The Armington subsystem drives Armington matrix demand and imports to equal country model demand and imports. Armington production approximately equals country model production. Exports are the residual of the process, and may differ significantly between Armington and country model numbers. The Armington subsystem could target imports and exports, at the expense of the stability of the solution.

Missing domestic price. Each country model currently uses only one reference price for a commodity. Some country models have only a producer or consumer price, not both. To completely use the Armington price information, country models should distinguish between consumer and producer prices in more cases.

Consider a regional model during Western Hemisphere integration. Producers in exporting countries should be better off as Armington export prices rise. Consumers in importing countries should be better off as weighted tariffs fall more than Armington import prices rise, giving a net reduction in consumer prices. However, the regional model may show producers and consumers facing the same domestic price, so either model producers or consumers lose.

Run time. The applied Armington procedure significantly slows the CLS, which is slow to begin with. (However, setup for scenarios always takes the largest amount of time, followed by writeup time.)

Run stability. The Armington subsystem is vulnerable to sparse matrices and discontinuities in models; therefore, world and country-specific Armington prices were averaged for the IATRC project (page 2).

Linker Concepts

Overview of the Linker

Extraction. First comes the extraction of cell equations, cell values, range names, and range addresses, from spreadsheet models.

Conversion. Next is conversion of extracted spreadsheet information to Fortran subroutines, in which

1. all relevant equations are retained to allow endogenous response to reference prices and to any other variables to be shocked,
2. equations are placed in an appropriate order for calculation,
3. circular or simultaneous blocks are located and expressed as Gauss-Seidel loops,
4. equations are added to set or reset endogenous reference prices and any shock variables at appropriate places, and
5. incoming reference prices and shock variables, and outgoing model results, are exchanged with the rest of the linked system.

Linking. The foreign country/regional models, the U.S. model (Fapsim), and the linker's rest-of-world and residual region are run together to find endogenous equilibrium world prices. The linker drives world net exports toward zero:

$\Sigma_{Countries}$Exports - $\Sigma_{Countries}$Imports $\rightarrow$ 0.

In equilibrium, world supply equals use, or

Beginning stocks + Production + Imports = Exports + Consumption + Ending stocks.

Therefore, balancing trade should be the same as balancing domestic supply and use:

Beginning stocks + Production = Consumption + Ending stocks.

In practice, there are some cases in which supply and use are not equal for particular country/commodity pairs.

The linker adjusts reference prices in the country/regional models, in proportion to changes in world prices. The following example is for the reference price (RP) of wheat in Japan:

$RP_{JAPAN,WHEAT,SCEN,t} = RP_{JAPAN,WHEAT,BASE,t} * RP_{WORLD,WHEAT,SCEN,t} / RP_{WORLD,WHEAT,BASE,t}$.

The linker also can shock an individual model into a new offset with respect to the world price; for example, such scenario shocks were introduced when modeling reductions of Export Enhancement Program benefits.

Currently, markets for animals are not explicitly cleared, but world prices for animals are adjusted in proportion to movements in the prices of relevant animal products. Thus, relative prices are kept approximately in line, but world trade in animals might not balance. Movements in various other world prices, for markets that are not cleared, are linked to the main markets that are explicitly cleared (see page 14).

Solution. Equilibration of trade involves multiple uses of Newton's method within Gauss-Seidel loops. The current solution methods are rather reliable, given that they are dealing iteratively with discontinuities in the country models; however, solution is slow and the discontinuities may

still prevent solution on some intervals of the implied world net export curves. The conservative solution procedures used by the CLS are dictated by the wish to keep Fapsim intact, and to accommodate possible abrupt changes in policy stocks in the United States.

1. The main damped Gauss-Seidel loop is over commodities in the Fapsim model, with an added linker procedure to loop over commodities not covered by Fapsim.
2. Nested within the overall loops over commodities, are loops within commodities to balance Fapsim, where Fapsim's trade equations are supplanted by the linker and the foreign country models. For a given commodity, Fapsim uses simultaneous equations in a loop with endogenous policies and prices for the commodity, and the linker balances any commodities not considered in Fapsim. For the soybean, soymeal, and soyoil complex, the three commodities are balanced simultaneously in Fapsim.
3. Each time that an attempt is made to balance a commodity in Fapsim, the foreign side is run with a Gauss-Seidel and Newton's method loop, to find foreign net trade in response to endogenous prices. Also noted is the foreign responsiveness to world price changes. The world price is adjusted repeatedly to cause endogenous foreign net imports to equal endogenous U.S. net exports. For the soybean, soymeal, and soyoil complex, the three commodities are balanced simultaneously on the foreign side, as in Fapsim.
4. Finally, there are loops in many of the country models that correspond to circular or simultaneous blocks. Loops within countries are Gauss-Seidel in the original spreadsheets, and as converted in the CLS. To the extent that Newton's method is applied to facilitate convergence, those equations are present in the spreadsheet models, and are not added by the linker's conversion program.

Spreadsheet Linking Requirements

A country spreadsheet might need to be modified to make it linkable:

1. the spreadsheet should be correctly convertible to Excel so that Excel can import it, or correctly convertible to SuperCalc or Lotus 1-2-3, version 2.01 so that SuperCalc can load it;
2. the completed, linkable version of the spreadsheet should be on a single sheet or page and should be operable without a macro;
3. the variables to be linked and their supporting cells should not contain division by zero, ERROR, N/A, string functions, or strings (just normal algebra instead); and
4. the spreadsheet should have no computed addresses, for example [1;2] or @coord(1;1;2;8), except in cells "linked" to other spreadsheets. "Linked" cells are converted to constants, so "linked" cells should not be functions of endogenous variables.

In addition, <u>for variables to be linked</u>, each spreadsheet should have:

5. each year in one column, with year columns consecutive, increasing toward the right;
6. each variable in one row, with a standard named range in the row;
7. standard commodity definitions (although the linker can aggregate commodities by summing); and
8. standard quantity units.

Only a subset of functions is converted.

Initialization and the Residual Region

<u>Initialization year</u>. The world is assumed to be in balance in the base or initialization year. That is, world supply is assumed to equal use, and exports to equal imports. The residual is selected automatically to make world demand+stock change equal world production in the base or initialization year. Similarly, the residual makes world imports equal world exports in the

initialization year. If there is any exogenous series available for world production or exports up through the initialization year, the residual causes the system to meet the exogenous series.

Baseline mode. When IFCSSW=1 (see page 24), the residual remains constant at initialization year levels during projected years, so the residual ignores any exogenous world production or export totals for years after the initialization year.

Post-Baseline mode. When IFCSSW=0, when the Baseline is accepted as given, the residual is set automatically such that world supply and demand equal use, and exports equal imports, in all years for the reference run portion of a scenario. Any exogenous world production or export totals are used in the reference run for projected years, as well as years up through the initialization year. Because the world initially is in balance for all years in post-Baseline mode, prices and quantities will not change until a shock is introduced.

The Rest-of-World (ROW)

The Rest-of-World (ROW) is a simple framework that covers the countries or regions that are not explicitly modeled in a given run. For a given commodity, ROW production and demand are automatically calculated from the sum of unmodeled countries/regions, up to the initialization year. Trend projections are used for the ROW's initialization year levels. After the initialization year, the ROW responds to current-period prices by using supply and demand elasticity matrices and price transmission elasticities. For a given commodity, the ROW includes a parameter to specify the extent to which trade or demand is the residual variable in the country's supply-use balance.

The ROW advances from one year to the next using a form of trend behavior. The ROW has growth rates for the inter-year change in production, consumption, and expected prices. It is possible to specify the extent to which the inter-year trend starts from the previous year's trend level or the previous year's equilibrium. The type of growth may be linear or exponential, or a combination of the two.

The ROW responds to income elasticities, and takes account of the extent to which consumption is for food versus feed. The growth rates in income and population are specified in a data file. Finally, the initial levels of income and population may be set.

Typical Country Model Equations

Let us consider a Cobb-Douglas exponential relationship between quantity (Q) and price (P), with an elasticity of ε:

$$Q = c\, P^{\varepsilon}.$$

We would like to avoid calculation of the constant **c**, so we will use information from the previous period (P_{t-1}, Q_{t-1}) to move to the current period (P_t, Q_t). We would also like to avoid use of exponentials and logarithms, which are slow to calculate, so we will use the Taylor series expansion for $Q(P)$ in the vicinity of $P = P_{t-1}$, and thereby make clear the sort of terms that will be dropped:

$$Q_t = \Sigma_{n=0}^{\infty} [f^{(n)}(P_{t-1})\, (P_t - P_{t-1})^n / n!].$$

$$Q_t = c\,P_{t-1}^{\varepsilon}\,(P_t-P_{t-1})^0/0!$$
$$+\ c\,\varepsilon\,P_{t-1}^{(\varepsilon-1)}\,(P_t-P_{t-1})^1/1!$$
$$+\ c\,\varepsilon\,(\varepsilon-1)\,P_{t-1}^{(\varepsilon-2)}\,(P_t-P_{t-1})^2/2!$$
$$+\ \ldots$$

The previous period levels P_{t-1} and Q_{t-1} are known in the current period. Therefore, we can make a linear approximation by retaining only the first two terms:

$$Q_t \approx c\,P_{t-1}^{\varepsilon}\,(1)/1 + c\,\varepsilon\,P_{t-1}^{(\varepsilon-1)}\,(P_t - P_{t-1})/1.$$

Simplify, replacing cP_{t-1}^{ε} with Q_{t-1}:

$$Q_t \approx Q_{t-1} + \varepsilon\,Q_{t-1}\,(P_t-P_{t-1})/P_{t-1}.$$

$$Q_t \approx Q_{t-1}\,[1 + \varepsilon\,(P_t/P_{t-1} - 1)].$$

If we examine the behavior of the preceding equation over more than one time period, then there is some compounding, and the cumulative response is nonlinear. That is because the equation refers to Q_{t-1} and P_{t-1}, and does not refer directly back to the initialization year Q_0 and P_0. Now, suppose that there are two commodities, wheat (W) and rice (R). The elasticity of the quantity of wheat with respect to the price of rice is ε_{WR}.

$$Q_W = c\,P_W^{\varepsilon_{WW}}\,P_R^{\varepsilon_{WR}}$$

If we again use the Taylor series expansion and drop all cross-product terms, we get an approximation for the wheat quantity in period t. The following approximation is typical of many of the country model equations. This linear functional form has been used by Mike Lopez, John Dyck, and Kim Hjort and Pierre Van Peteghem (Hjort and Van Peteghem, 1991).

$$Q_{Wt} \approx Q_{Wt-1}\,[1 + \varepsilon_{WW}\,(P_{Wt}/P_{Wt-1} - 1) + \varepsilon_{WR}\,(P_{Rt}/P_{Rt-1} - 1)].$$

The growth rate of the wheat quantity is the sum of the growth rates of the explanatory variables, scaled by the respective elasticities:

$$\dot{Q}_W \approx \varepsilon_{WW}\dot{P}_W + \varepsilon_{WR}\dot{P}_R$$

The new wheat quantity is the prior wheat quantity, plus the contribution from the growth in the wheat price, plus the contribution from the growth in the rice price:

$$Q_{Wt} \approx Q_{Wt-1}$$
$$+\ Q_{Wt-1}\,\varepsilon_{WW}\,(P_{Wt}/P_{Wt-1} - 1)$$
$$+\ Q_{Wt-1}\,\varepsilon_{WR}\,(P_{Rt}/P_{Rt-1} - 1).$$

Because the quantity in each year depends on the previous year's level, the level in the initialization year (the "base value") serves as the constant and determines the scaling of the projected series. The level of Q at the end of time interval T, in terms of the initialization year 0, can be expressed with the Cobb-Douglas form or the linear approximation, which repeatedly multiplies by the growth from previous years:

$$Q_{WT} = Q_{W0} \ (P_{WT}/P_{W0})^{\varepsilon_{WW}} \ (P_{RT}/P_{R0})^{\varepsilon_{WR}}$$

$$Q_{WT} \approx Q_{W0} \ \prod_{t=1}^{T} \ [1 + \varepsilon_{WW} \ (P_{Wt} / P_{Wt-1} - 1) + \varepsilon_{WR} \ (P_{Rt} / P_{Rt-1} - 1)].$$

Linked System Process Flow Charts

Figure 2, on page 51, shows selected parts of the flow of information in the linked system. Each box shows the information or work performed at that stage, and the individuals who usually perform the processing. The curved lines show feedback. The processes concern data, models, linking, output, and feedback. Calibration of models occurs after completion of the Baseline. Various processes and individuals may have been missed in Figure 2; please feel free to inform the author of this report.

Figure 3, on page 52, shows an overview of information flowing into and out of the linker. Shaded boxes indicate user interaction. The linker programs include the rectangular boxes. Backward-leaning parallelograms represent input to the linker. The Fortran Conversion and Linked System Run input parallelograms each describe multiple control files. Forward-leaning parallelograms represent output from the linker. On the left side of the chart, the 48- and 25-commodity data tables are simply different versions of the same file, and the two data aggregation boxes represent the same programs, used in slightly different ways. In the upper-right corner, the link tables contain information both on intentional unlinking, and on any problems with linking.

FIGURE 2--CLS PROCESS FLOW, SELECTED

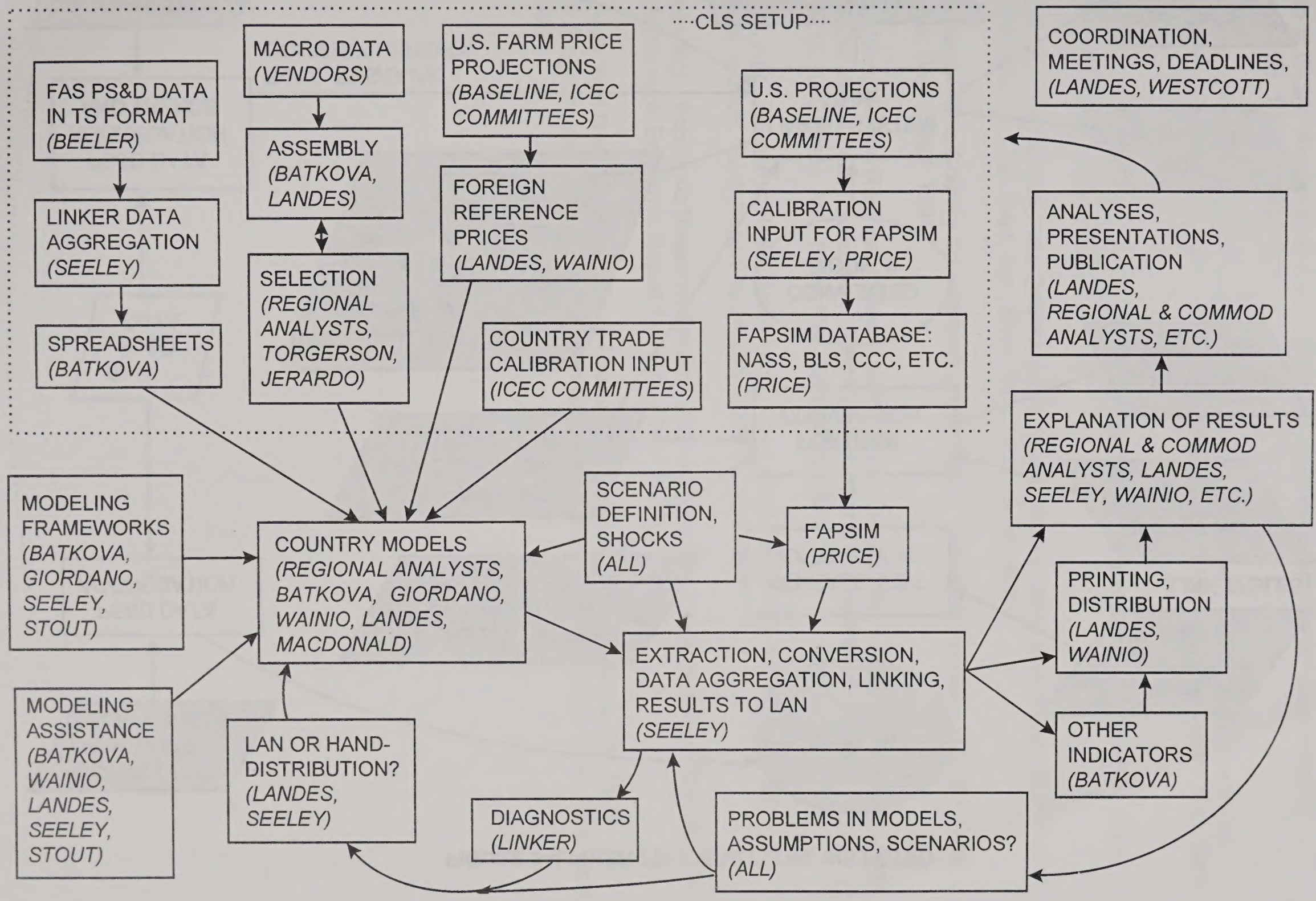
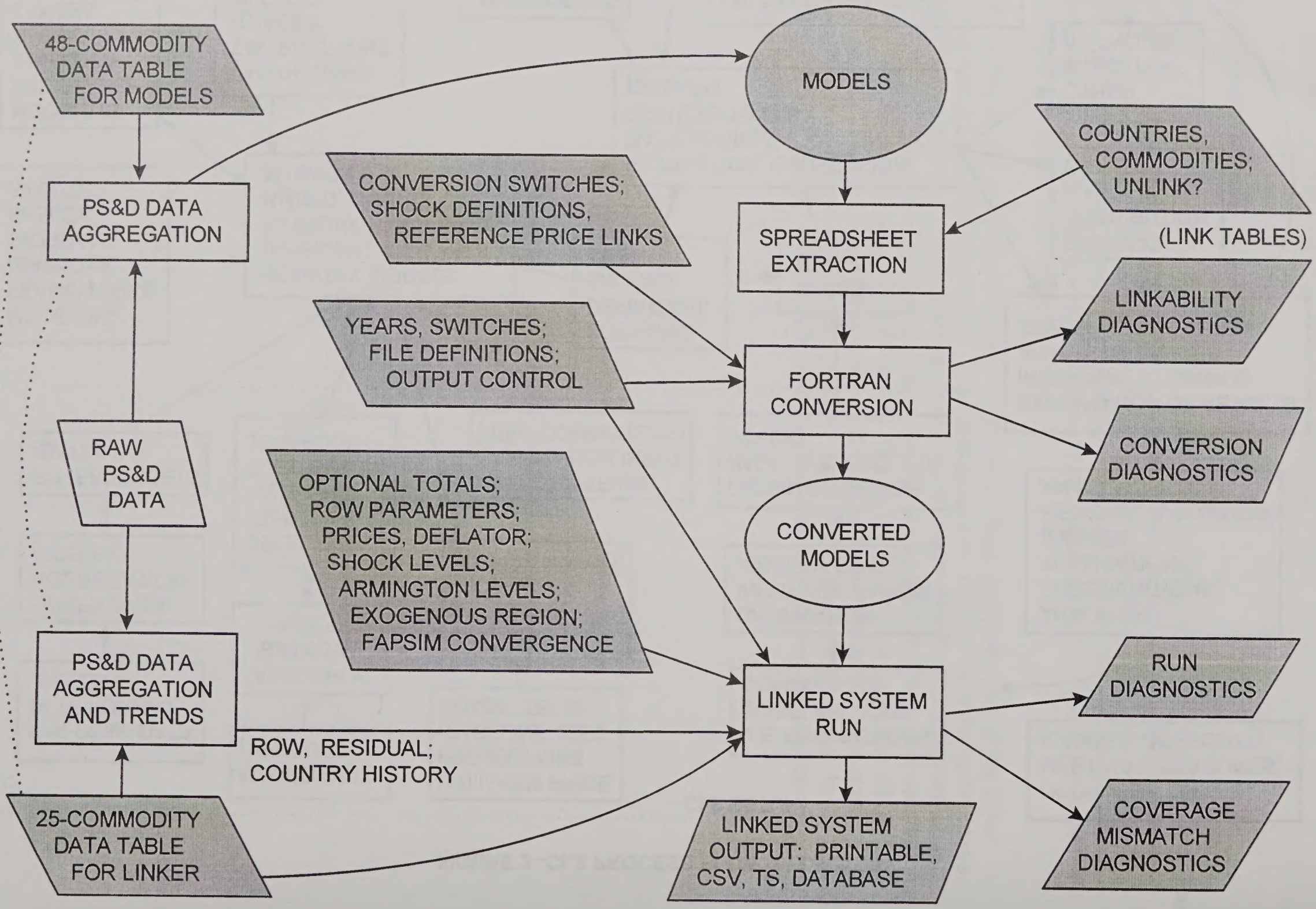


FIGURE 3--LINKER PROCESS FLOW, SELECTED



References

Fischer, Günther, and Klaus Frohberg. "The Basic Linked System of the Food and Agriculture Program at IIASA: An Overview of the Structure of the National Models," *Mathematical Modeling*, 3(5), 1982, pp. 453-466.

Hjort, Kim, and Pierre Van Peteghem. *The CPPA Model-Builder: Technical Structure and Programmed Options in Version 1.3.* Staff Report No. 9144. U.S. Dept. Agr., Econ. Res. Serv., Aug. 1991.

Roberts, Blaine, and David L. Schulze. *Modern Mathematics and Economic Analysis.* New York: W. W. Norton & Company, 1973.

Seeley, Ralph. *Equilibrium Price Solution of Net Trade Models Using Elasticities.* Staff Report No. AGES 860610. U.S. Dept. Agr., Econ. Res. Serv., June 1986.

Seeley, Ralph. "The Country Spreadsheet Linker (CSL)." No series number. U.S. Dept. Agr., Econ. Res. Serv., Sept. 1994.

Sullivan, John, Vernon Roningen, Susan Leetmaa, and Denice Gray. *A 1989 Global Database for the Static World Policy Simulation (SWOPSIM) Modeling Framework.* Staff Report No. AGES 9215. U.S. Dept. Agr., Econ. Res. Serv., May 1992.

U.S. Dept. Agr., Economic Research Service. *Long Term Projections for International Agriculture to 2005.* Staff Report No. AGES 9612. August 1996.

U.S. Dept. Agr., Economic Research Service. *International Agricultural Baseline Projections to 2005.* Agricultural Economic Report No. 750. May 1997.

Webb, Alan, Karl Gudmunds, and Gene Hasha. *TS Software User Manual for the TIME SERIES Program and Utilities.* Staff Report No. AGES 9302. U.S. Dept. Agr., Econ. Res. Serv., Feb. 1993.